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MAY 21, 1956

American Machinist

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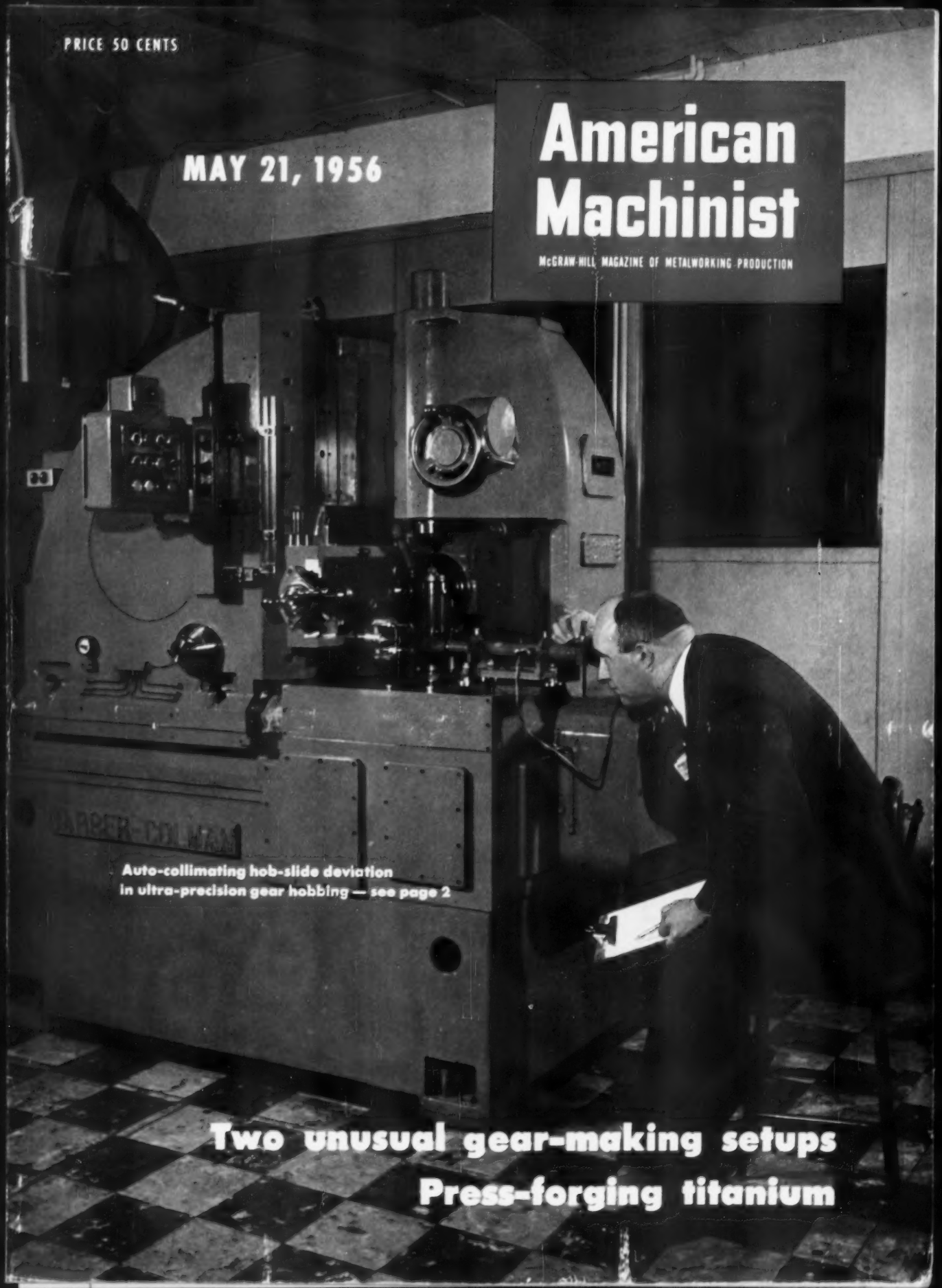


Auto-collimating hob-slide deviation in ultra-precision gear hobbing — see page 2

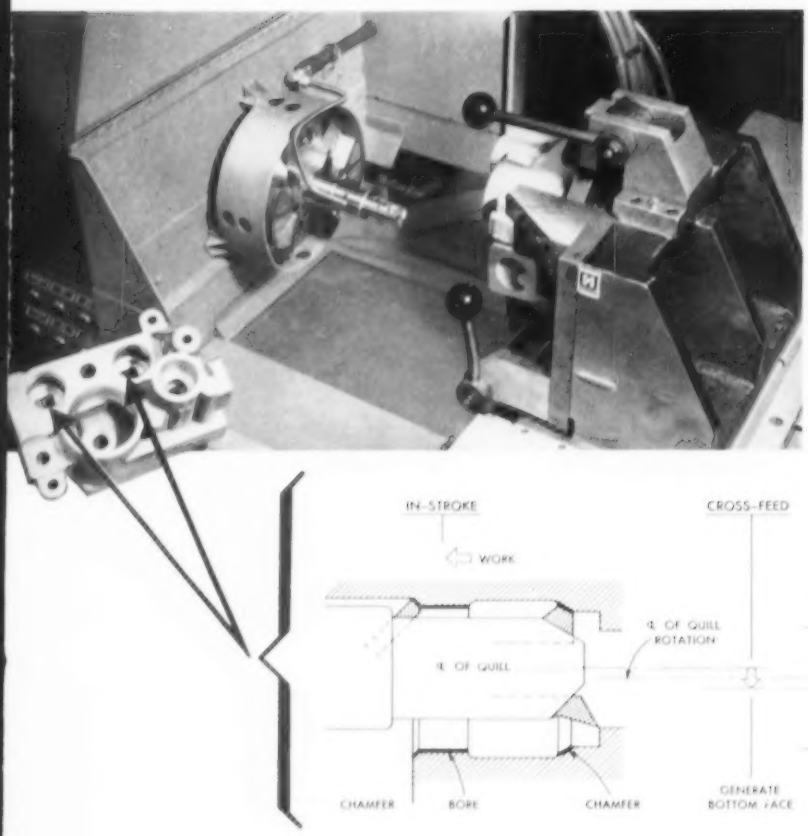
Two unusual gear-making setups

Press-forging titanium

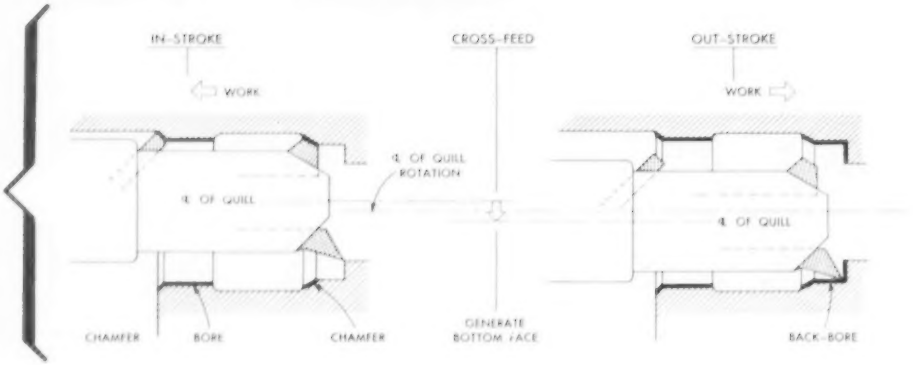
Heald BORIZING boosts production of aircraft filter bodies

from 8 PARTS PER HR.

to 33 PARTS PER HR.



another example of how a simple Borizing setup can do a better job, faster, and at much lower cost



THE fixture and tooling setup in the photo above looks like a very simple one — and it IS! Yet this single, three-point quill Borizes two chamfers, two I.D.s and a bottom face on each of two identical bores in an aluminum aircraft filter body, all in a single, fully-automatic cycle with only one chucking of the part.

As the diagrams show, the job is done with a cross feed unit on the Borizing quill to present the tooling to the work in the proper sequence. Auto indexing of cross slide positions work for Borizing the two identical bores in sequence.

Compared to the previous method of doing the same job, this Model 221 Bore-Matic increased production from 8 parts to 33 parts per hour, with closer tolerances, better finish, easier operation and less maintenance.

The *simplicity* and *versatility* of Heald Borizing permits important savings on an almost unlimited range of work and finishing operations. Another big reason why it *pays* to come to Heald.

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

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HEALD

American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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chips

ULTRA-PRECISION . . . Sperry Gyroscope is completing a program that will result in ultra-precise gears. Our cover shows the Barber-Colman hobber that is part of the program, but there are so many other factors including tooling, inspection, and technique in general that we have made this exclusive story our current Special Report. On our cover, Ronald J Ross, senior engineer, Engineering Division, Sperry, project engineer for the program, checks deviations of travel of the hob slide as it moves down. He is using an auto collimator and a flat mirror and is worrying about millionths of an inch here and angular seconds on the stainless-steel gears that result.

MISSILE ESSENTIAL . . . With the gear manufacturers meeting early next month, it is no coincidence that we take a close look at two important developments in precision gears. First is the aforementioned Special Report, which shows why and how it took a half-million-dollar program to produce gears with non-adjacent tooth errors less than 10 sec of angle. An error of 1 min means missing the target by a mile at a 5000-mile range. That's not good enough any more. Reducing that error to seconds makes a story that will mean a lot to every production man with *millionths* in his future.

BROACHED GEARS . . . The second gear story tells how large internal gears are broached in special setups at Detroit Transmission at higher production rates and with better accuracy and finish than with former methods.

TITANIUM FORGING . . . The large hydraulic forging presses, up to 50,000 tons, in the Grafton plant of Wyman-Gordon are now in regular operation. From production runs of titanium comes new knowledge on press forging of this material, reported by John Wright in cooperation with Arnold Rustay, director of research at Wyman-Gordon.

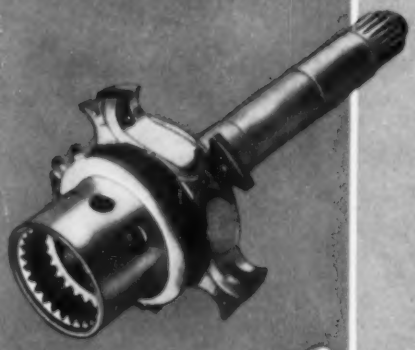
HEAVY FORMING . . . The Caterpillar name has long been synonymous with heavy earthmoving equipment. Heavy forming and welding operations predominate in the new Decatur plant—opened to the public this week. Arthur W Johnson, manager of manufacturing at the new plant, takes you on a picture-caption tour that covers the high spots of the production lines.

MILLING AND SHAVING . . . An 8-tooth face mill is being developed at Convair to use throwaway carbide bits. We report test results of an embryo 2-tooth cutter, the newer 8-tooth cutter, and list ten advantages. . . . A special press at Friden has converted an old nuisance into a productive force. Vibration is employed to provide smooth shaving of stainless cams.

COMING . . . *AM* for June 4 will feature the second Special Report on dies for plastic molding, this one dealing with transfer and compression molds. Other articles will deal with bandsawing titanium, abrasive cutoff operations, wire brushing, and production scheduling for large units.

R J RIZZO is the author of our Reference Book Sheets on bend allowances in this issue. He is a consulting engineer with 22 years of experience in product design, tooling, and production. A graduate of Brooklyn Polytechnic and a registered professional engineer, he was formerly chief engineer of the Brach Div, General Bronze Corp. His career started with an apprenticeship and several years as a journeyman toolmaker. Then he was a tool and machine designer for Ward Leonard Electric Co, and later for Eclipse Aviation. While finishing at Brooklyn Poly, he became plant supt of Affiliated Machine and Tool, then head of the methods and tool design dept at Bendix Aviation. He was chief engineer of Weston International Associates, then shop supt of G & M Machine Products, before joining General Bronze.

Pinion carrier for an aircraft planetary reduction gear.



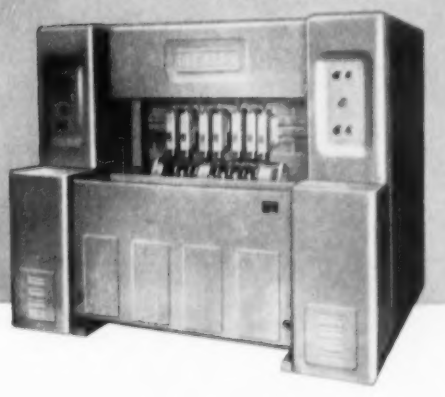
Impeller shaft for aircraft supercharger.

Aircraft cam gear.

Breech block for an automatic rifle.

The Gleason No. 26 Quenching Press for parts up to 25″ in the maximum dimensions.

The Gleason No. 140 Quench Machine for shafts and similar parts 5/16″ to 4″ in diameter, up to 43″ in length.



How to hold parts like these to close tolerances during quenching

Are you troubled by warpage or distortion of precision parts during hardening?

If you have this problem, Gleason Quenching Equipment can help solve it with substantial savings in costs.

This equipment provides automatic, controlled quenching of flat, round, irregular, or shafted parts insuring alignment and minimizing distortion.

For round, flat or irregular parts up to 36″ in the maximum dimension there are three sizes of Gleason Quenching Presses of the type shown at the top right.

For shafts or similar parts there is the Gleason Rolling Quench Machine, shown at lower right. It accommodates shafts from 9/16″ to 4″ in diameter, from 6″ to 43″ in length, and can handle parts with integral cams, gears or shoulders up to 8″ in diameter.

In all these machines the heated part is held under pressure. Flow of the quenching fluid to each portion of the heated part is accurately controlled at preset rates during all stages of the quenching cycle.

In the Quenching Presses precision dies hold the part in alignment and direct the flow of quenching medium during the quenching cycle. In the Rolling Quench Machine the part is rolled under controlled pressure. Relative pressures applied to the various portions of the part are accurately and automatically controlled.

The use of Gleason Quenching Equipment eliminates the need for any subsequent straightening. This is important for two reasons: (1) It saves one operation, reducing production costs. (2) Hardened parts which do not require straightening have less residual stress. Further information will gladly be sent on request.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

Complete cycle stops every twenty seconds

. . . Cost Savings

Automatic reciprocal milling setups, with center safety stop, may be assigned to Automatic Cycle Machines. That's because automatic backlash eliminator is a standard feature.

AUTOMATIC RECIPROCATING FEED CYCLE

Here's a way to turn in a better cost performance record when you have high production milling jobs sandwiched in between toolroom quantity lots. Just assign all of them to a machine equipped for both high production and toolroom milling. ¶ In the 3 and 5 hp class, CINCINNATI® ML and MI Automatic Cycle Milling Machines will give you the best cost performance record you've ever seen. You can use the automatic table cycles or not, as desired. And for extra high production setups, like the one illustrated here with a fixture at each end of the table, you'll appreciate a CINCINNATI more than ever because of these two advantages:

1) Automatic backlash eliminator
2) Center safety stop

Both are standard features of the ML and MI Automatic Cycle Milling Machines. And for a little extra you can also

CINCINNATI

CIN

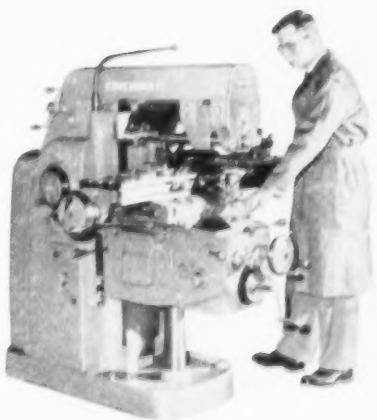
MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING

A high production two-fixture setup on a CINCINNATI No. 2MI Plain Automatic Cycle Milling Machine.

Continue For Years

have *automatic spindle stop*. Then the complete cycle stops while the operator reloads the fixtures; savings in time and money and improvement in operating safety are evident for years. ¶ Automatic table cycles in no way affect the versatility of the ML's and MI's for small quantity production. With the exception of the single four-position table control lever, all controls and operating levers are the same as before . . . there are 16 feeds ¼" to 30" per minute; 16 spindle speeds 25 to 1500 rpm (lower and higher ranges optional); 150" per minute power rapid traverse. Both the plain and vertical styles are available with automatic table cycles. Want to know more? Look in Sweet's machine tool file, or write for catalog No. M-1916.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



CINCINNATI No. 2MI Plain Milling Machine. Complete specifications may be obtained by writing for catalog No. M-1916.

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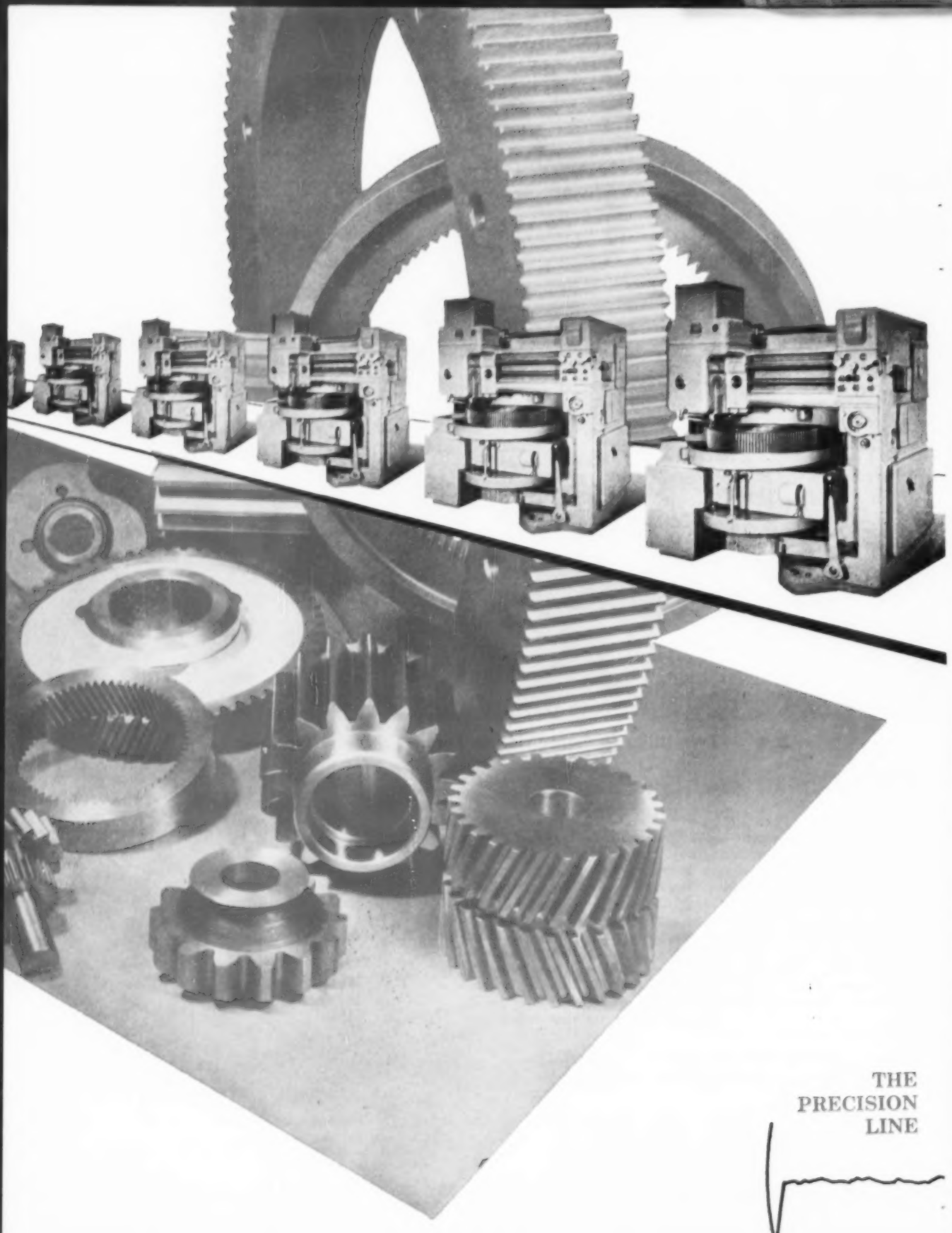
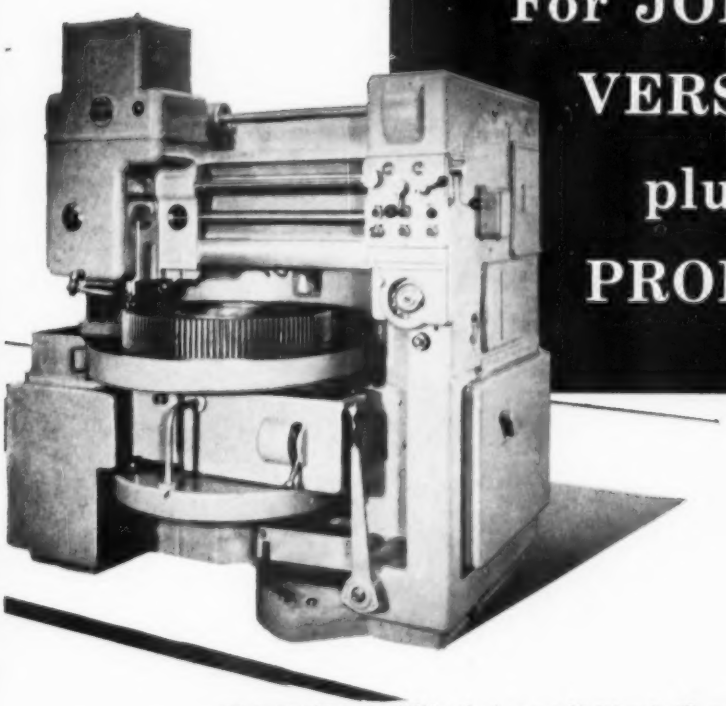


THE
PRECISION
LINE



For JOBBING VERSATILITY plus HIGH PRODUCTION

HERE'S versatility that pays dividends. For the Fellows 36-Type Gear Shaper has real "earning power"... whether used to handle virtually every job that comes up in a small gear department... or concentrated upon the heavy work in a large production shop.

A powerful, ruggedly constructed, heavy duty machine, the 36-Type can take extra heavy cuts at high speed... yet hold close limits. Low set-up time, fast gear-shift change from heavy to fine feed, quick dial adjustment from one cutter-spindle speed to another... these are just a few of the ways the 36-Type keeps down costs.

Ask your Fellows Representative to explain *all* the profit-making advantages built into the 36-Type... as well as the Fellows Plan for deferred payment. Write, wire or phone any Fellows Office!

THE FELLOWS GEAR SHAPER CO., Head Office and Export Dept., 78 River St., Springfield, Vermont
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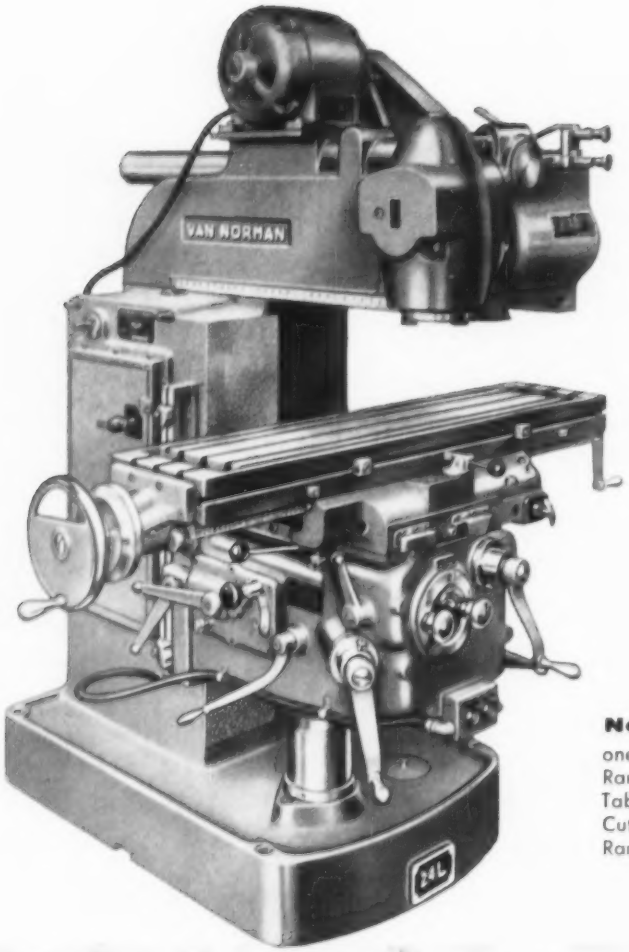
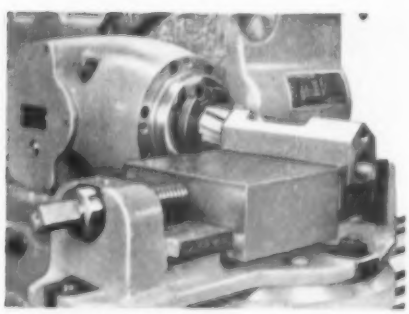
Fellows *Gear Production Equipment*

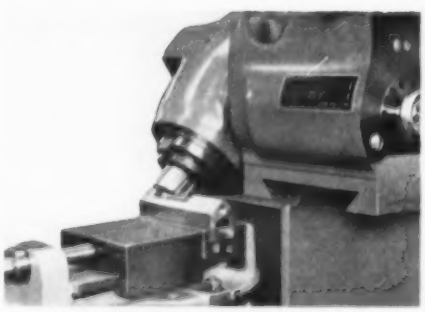


No. 24 L...
one of 14 new Van Norman
Ram-Type Millers
Table Size: 45" x 10½"
Cutterhead Motor: 3 HP
Ram Travel: 29"

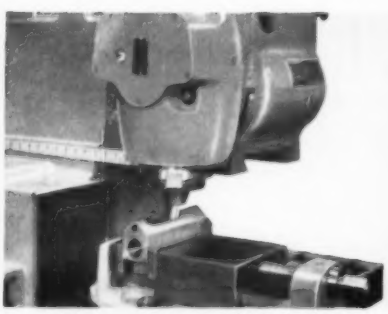
Here's how you eliminate idle machine time by as much as 50%...increase production



HORIZONTAL — A typical horizontal milling operation performed on the new Van Norman Ram-Type Miller.



ANGULAR — An angular milling operation performed on the same workpiece. Note workpiece remains in the same set-up. Angular range of cutterhead 0°-90°.



VERTICAL — With the cutterhead locked in vertical position a slot is milled in the workpiece. Note the set-up has not been changed.

VAN NORMAN MACHINE

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grihders.

You Don't Need
TWO
Single-Purpose Machines plus
Attachments when
ONE
VAN NORMAN
Ram-Type Milling Machine
Does the Same Work
at Lower Cost

A single investment in *one* Van Norman Ram-Type Milling Machine gives you the equivalent of two separate millers plus attachments at the much lower cost of a single machine. Not only do you save machine purchase dollars, but with a Van Norman you get increased production with substantial savings in milling costs.

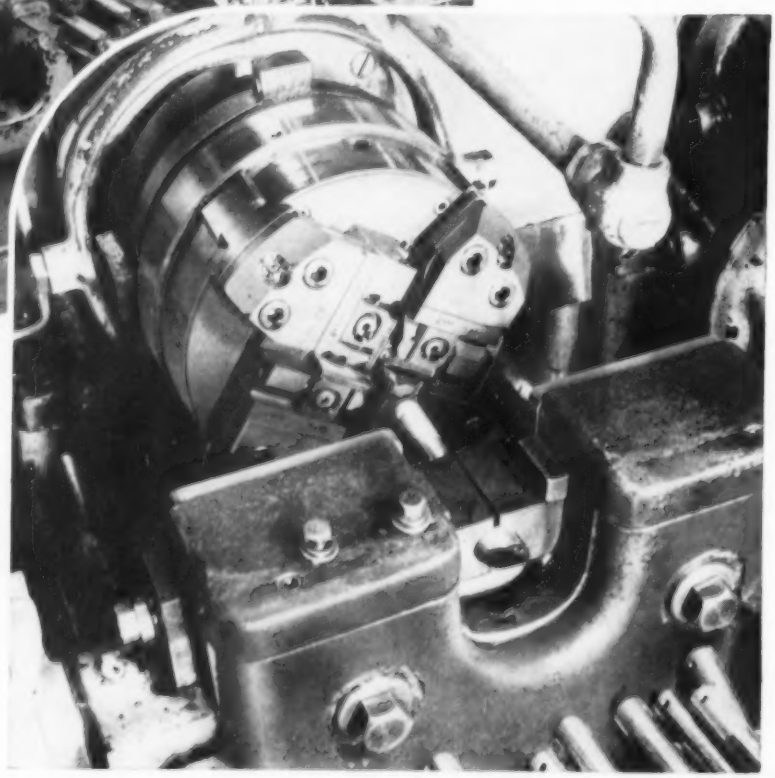
14 new models with cutterhead motors ranging from 2 HP to 10 HP and table sizes from 40½" x 10" to 64" x 14" give you a wide range of selection. Write for complete information today.

Van Norman Machines are available on five purchase plans — Outright sale . . . Purchase on conditional sales contract up to 5 years . . . Pay as you depreciate . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Co. Lease and Conditional Sales Contracts not available to Export.

COMPANY

SPRINGFIELD 7, MASSACHUSETTS

BOLTS threaded ON A



THE WORLD'S

to ±.001

LANDMACO MACHINE

Using LANDIS Threading Equipment, the Chicago Screw Company of Bellwood, Illinois, is able to thread connecting rod bolts to better than Class 4 fit at normal production rates and economical tool cost.

Bolt blanks are of 8640 steel of 30-36 Rockwell "C" hardness. 11/16" diameter 16 pitch UN form threads must be cut 1-7/16" long over a cotter key hole. Specifications required a ±.001" tolerance on the Pitch Diameter of the thread, and finished threads are closely inspected for concentricity.

To perform this operation a 1½ LANDMACO Double-Spindle Threading Machine equipped with Leadscrew, Hardened and Ground LANCO Heads, and Chasers of special throat length and hardness was installed. In normal production, this LANDMACO Machine regularly completes 127 threaded pieces per hour cutting at 15 surface feet per minute. On an average 400 threads per head are produced between each regrinding of the chasers.

This installation illustrates the production advantages of LANDIS Equipment for difficult and exacting threading operations. The mechanically-controlled positive feed of the Leadscrew, the maximum rigidity of Die Heads designed for precision threading, and Chasers of special specifications—allow threading hard material with minimum cutting strain. As a result, threads are produced to close tolerances at economical production rates and low tool cost. For further information, ask for Bulletins H-75 (LANDMACO Machines) and F-80 (Hardened and Ground Heads). Please send specifications when writing.

LARGEST MANUFACTURERS OF THREAD GENERATING EQUIPMENT

• LANDIS *Machine* CO. WAYNESBORO PENNSYLVANIA •

Stationary and solidly supported work

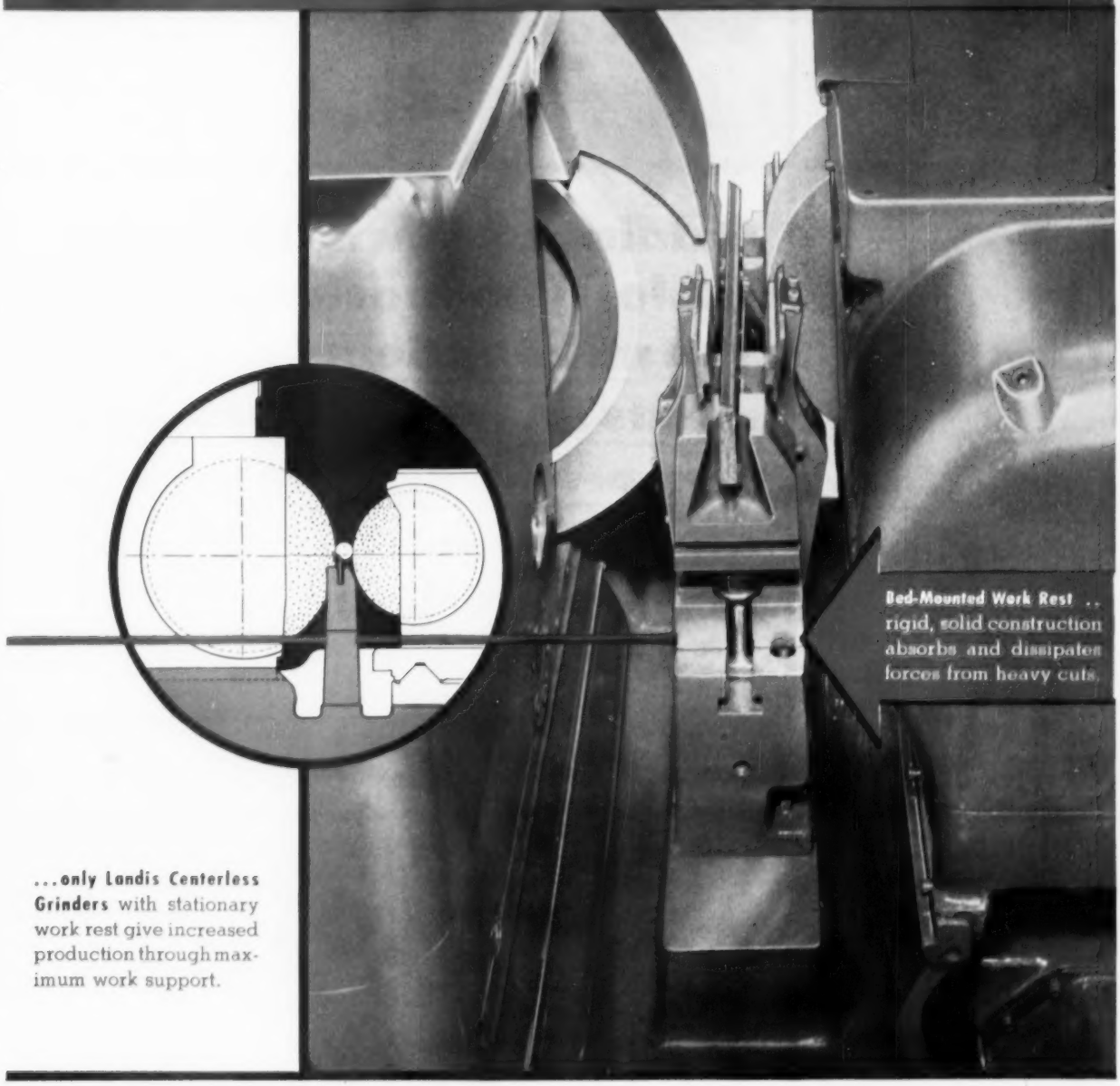
Gives finer finishes, greater precision with heavy cuts

Landis No. 12 Centerless
Send for new catalog T-55

LANDIS

precision grinders

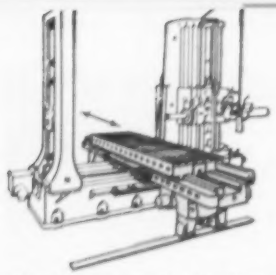
rest cuts centerless grinding costs



Bed-Mounted Work Rest .. rigid, solid construction absorbs and dissipates forces from heavy cuts.

...only Landis Centerless **Grinders** with stationary work rest give increased production through maximum work support.

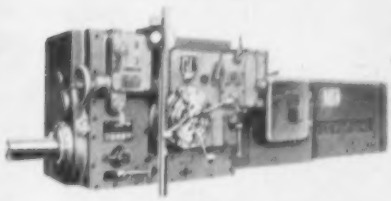
LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA



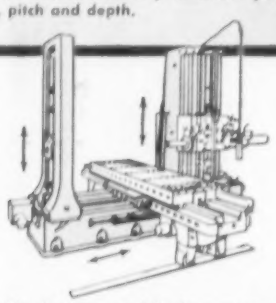
Increased table sizes, extended saddles, saddle supports and auxiliary runways — foundations in-the-floor or over-the-floor types.

Built-in rotary tables with power milling feeds available with round, square or rectangular platens in various sizes.

Auxiliary combination plain and hand feed rotary tables available with round, square or rectangular platens in various sizes.

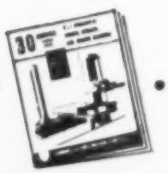


Built-in thread lead device permits cutting of precision threads to any standard prescribed form, pitch and depth.

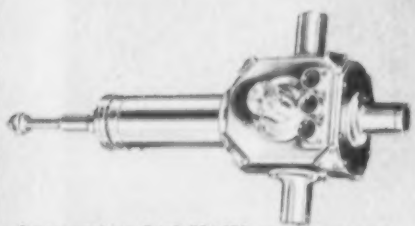


Full ribbed column and bed assures maximum rigidity. Machines available in various increased column and end support heights plus increased bed lengths.

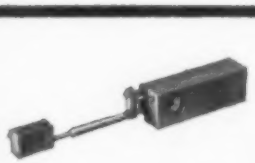
Giddings & Lewis 30 Series table-type machines give you more optional arrangements . . . more accessories . . . more attachments than any other horizontal bar in the world!

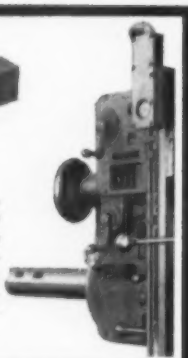


• For complete specifications on G&L 30 Series Table-Type Horizontal Boring, Drilling and Milling machines ask for Bulletin No. 345.



Super-sensitive Dupli-TRACER assures accurate 2- or 3-dimensional stepless contour tracing and 360° profiling. Another important feature is a manual steering control.

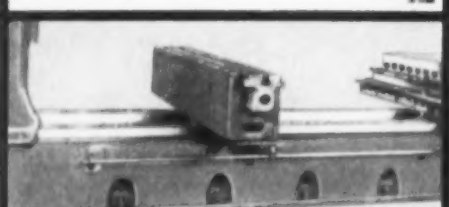




Automatic, electrically-operated positioning device for both headstock and table travel assures accurate machine settings repetitive to .0002" . . . eliminates time-consuming fine hand adjustments.

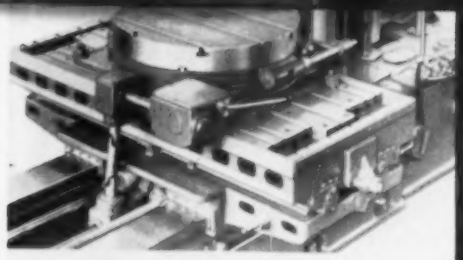
Heavy-duty, single-spindle, angular milling attachment operates at right angles to machine spindle. Offers unusual flexibility for machining hard-to-reach surfaces.

Continuous feed facing and boring heads used either separately or in combination with other attachments or accessories for turning, facing, threading, back facing, grooving, etc. Telescopic, right angle and facing tool holders, and high speed grinder are also available.

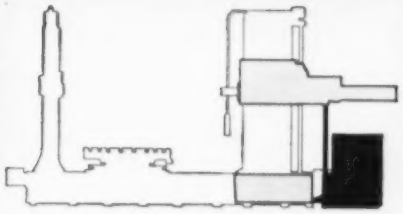


Plain or sliding platen auxiliary tables, mounted between table and end support, add extra rigidity in machining long workpieces which overhang the width of table.

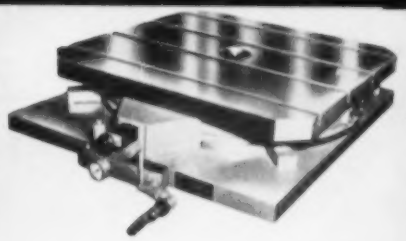
Improved measure device, used in conjunction with precison end measure rods (complete sets or individual units) is employed where extreme accuracy is required — readings to .0001". Device includes vertical and horizontal measuring unit to indicate vertical travel of headstock . . . cross travel of table on saddle . . . also for transverse saddle movement.



Auxiliary combination plain, hand and power take-off feed rotary tables available with round, square and rectangular platens in various sizes.



The exclusive G&L "Lubri-Cool" system, shown connected to headstock and milling feed unit, assures machining accuracy under heavy loads and in ambient temperatures.

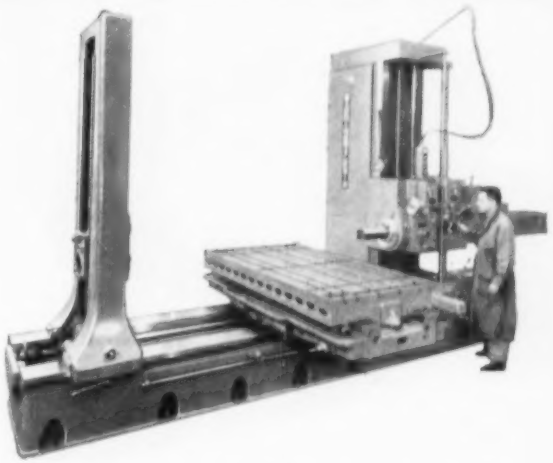


New G&L Air-Lift rotary table literally "floats on air." Capable of 360° indexing off center loads . . . eliminates multiple setups. Available with round, square or rectangular platens.

Here's why the world's favorite, profit-making Horizontal Boring, Drilling and Milling machines are Giddings & Lewis 30 Series, table-types — Model 340-T with 4" dia. spindle (20-hp motor) and Model 350-T with 5" dia. spindle (25-hp motor). It's because of their ability to be adapted to handle an extremely broad range of work when equipped with any of a big variety of optional equipment, attachments and accessories.

Year in and year out these machines continue to offer you more new features — such as the exclusive "Lubri-Cool" system. You'll discover too, that no other machine on the market today offers you so many distinct performance and capacity boosting features for boring, drilling and milling.

Yes, there's no better time than now to find out how much more work these machines can do in your shop. Contact your Giddings & Lewis representative today. He'll be glad to give you all the facts.

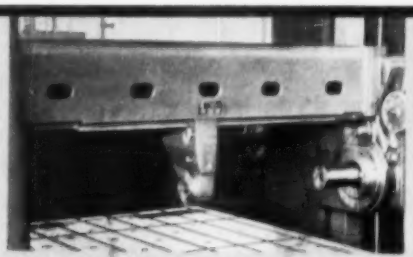


G-58

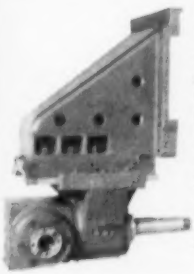
G&L and HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines—table, floor and planer types; HYPRO Double Housing and Open Side Planers, Planer Type Milling Machines and Vertical Boring Mills; Vertical Turret Lathes; Spar and Skin Milling Machines, and VARIAX machines.

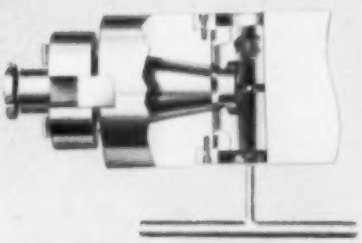
Heavy-duty, two-spindle angular milling attachment handles heavy cuts with high power outer spindle. Medium-duty inner spindle used for a wide range of drilling, boring, light milling and other work.



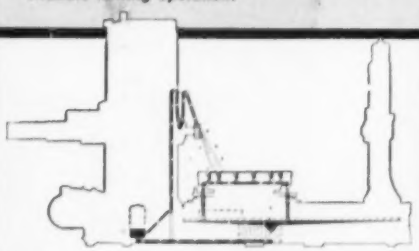
Cross-rail type arbor support in various lengths permits setting of milling cutters at any position over the table. It's ideal for slab, gang and straddle milling operation.



Right angle, heavy-duty sliding-head angular milling attachment with adjustable overarm support is practical for heavy milling, boring, drilling, reaming, etc. Medium-duty unit also available for machining at any angle in large openings and cavities.



Optional Quick-Change or Morse taper spindles available. Quick-Change spindle positively retains or ejects cutting tools by means of a simple wrench adjustment.

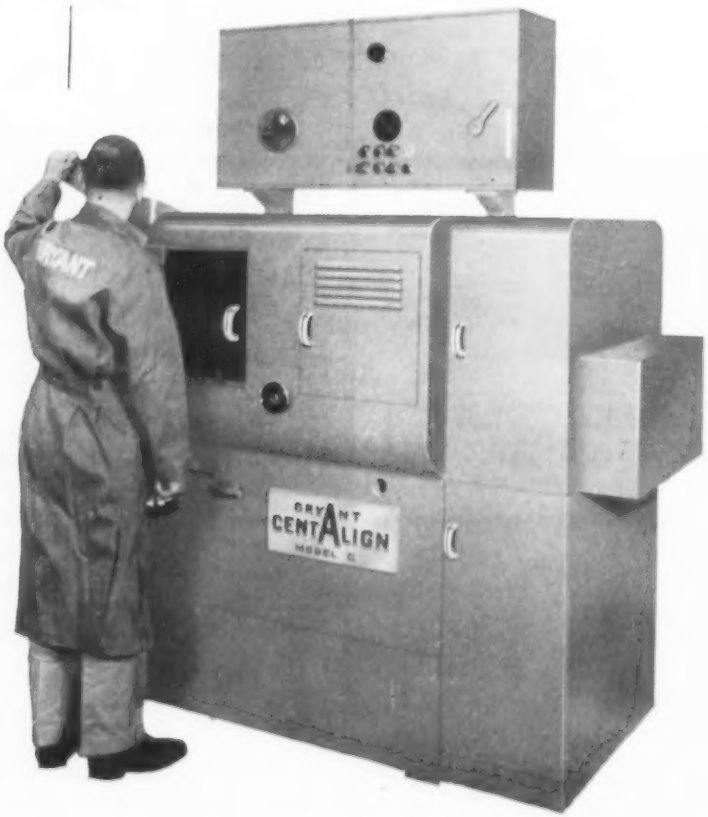


High volume coolant system on 30 Series machines assures an adequate supply of coolant to cutting tool. Table tee-slots are closed at the ends . . . table and saddle drilled allowing coolant to pass into a trough attached to bed of machine. Coolant tank is cast in the bed, or optional tank may be installed in floor.

Davis Super Micrometer Stub Boring Tools, available in complete sets, speed boring in production and tool room work. Line bars with block type or micrometer expansion tools also available.

completely

BRYANT CENTALIGN



new in concept and design...

The Bryant "Centalign" Automatic Internal Grinder

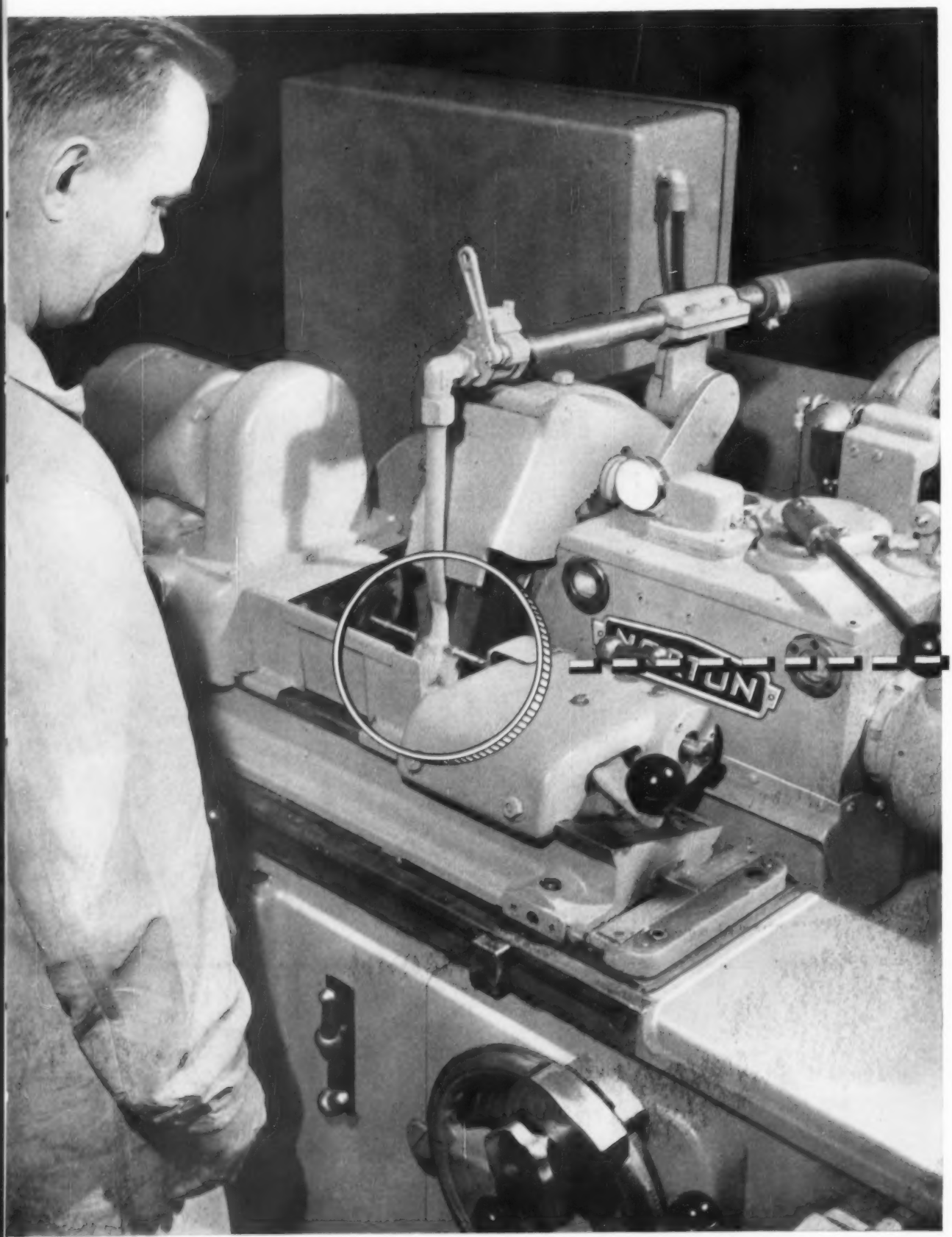
Here is the machine you've asked for! The Bryant Centalign is specifically designed for the higher-production, lower-cost internal grinding of bearing raceways and taper bores, and for similar operations. It embodies the latest developments in shoe centerless grinding, and is adapted to automated lines. Ask for a demonstration.

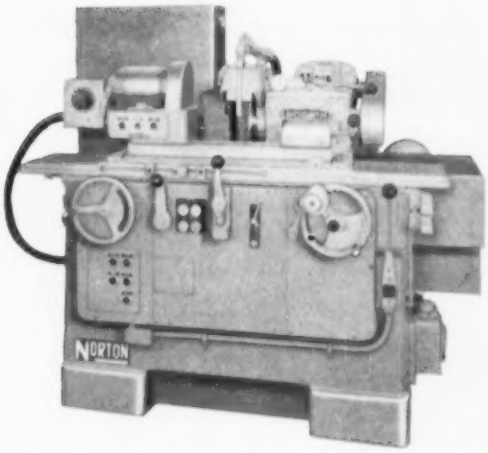
BRYANT Chucking Grinder Co.

10 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates • Magnetic Drums for Computers





New Norton 4"x18" Type CTU Cylindrical Grinder

gives you high precision plus high production . . .

makes small parts pay off big

Here's a cylindrical grinder you can get as either a Plain Machine for traverse work, or as a Semiautomatic for plunge operations.

Either way you get faster, more accurate, more profitable grinding of a wide variety of small parts. Because either way the 4" Type CTU's Norton-developed features bring a new ease of operation for your men — and a new high in production quality and quantity for *you*.

To name just one of these advanced features, there's the extremely rugged wheel spindle unit that assures enduring precision in jobs ranging from heavy stock removal to fine finishing. Then there are optional profit-boosting extras like the new SWIVALIGN Dual Electric Indicator for measuring swivel table adjustment, and an Automatic Wheel Truing Device. But why not get the whole story of this speedy, profit-boosting grinder from your Norton Representative or write for Catalog No. 531.

The Norton Lease and Purchase Financing plans enable you to modernize while conserving your capital, and remember: only Norton offers you such long experience in both grinding wheels and machines — to help you produce better products at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass.

To Economize, Modernize With NEW

NORTON

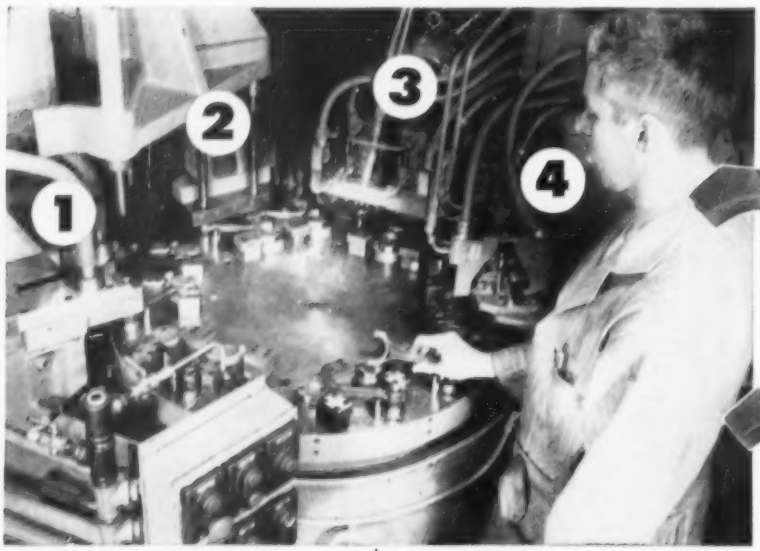
GRINDERS and LAPPERS

Making better products . . . to make other products better

District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit • In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5, Ontario

4 ANOTHER *American* FIRST

operations on 720 connecting rods per hour

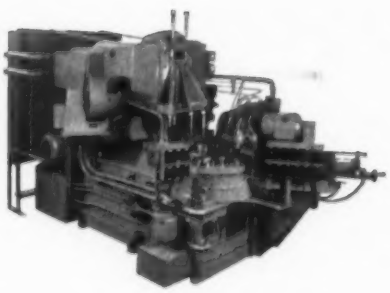


1	**ASSEMBLE WRIST PIN BUSHING**	**3**	**SPOT DRILL 1/8" OIL HOLE**
2	**BURNISH BUSHING I. D.**	**4**	**FINISH DRILL OIL HOLE**

Equipped with six, two-station locating fixtures, mounted on a rotating index base, this American machine does four operations at the rate of 720 pieces per hour (approximate at 100% efficiency).

At the first station, bushings are pressed into the wrist pin holes of the automotive connecting rods. At the next station, two American HSS burnishing tools burnish the holes and seat the bushings. The base then indexes the parts into position for two consecutive, horizontal drilling units. The first moves in to spot drill an oil hole and the second unit finish drills the hole through one wall. Operator unloads and reloads two parts at a time at the leading station.

American engineering can help you devise new and better ways to machine assemble parts — to combine operations and cut production costs. You can enlist American's long experience in this type of machine building by 'phone — or writing us details of your requirements. Why not do it today?



Note hopper feed and fully automatic push-button control.

Write for this new manual of broaching and machine assembly. Ask for Catalog 450.

AMERICAN *American* BROACH & MACHINE CO.

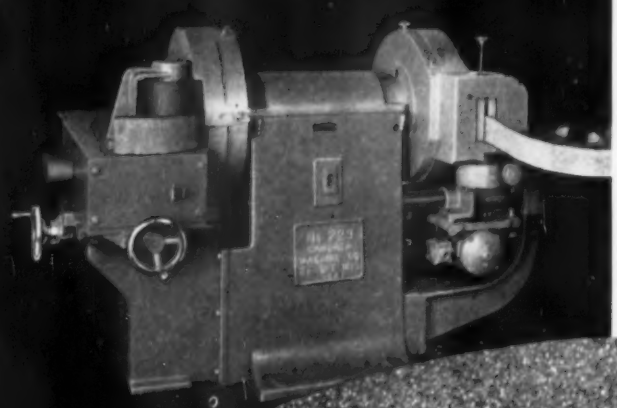
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

Change in Grain Size and Structure Cuts Abrasive Costs 80%



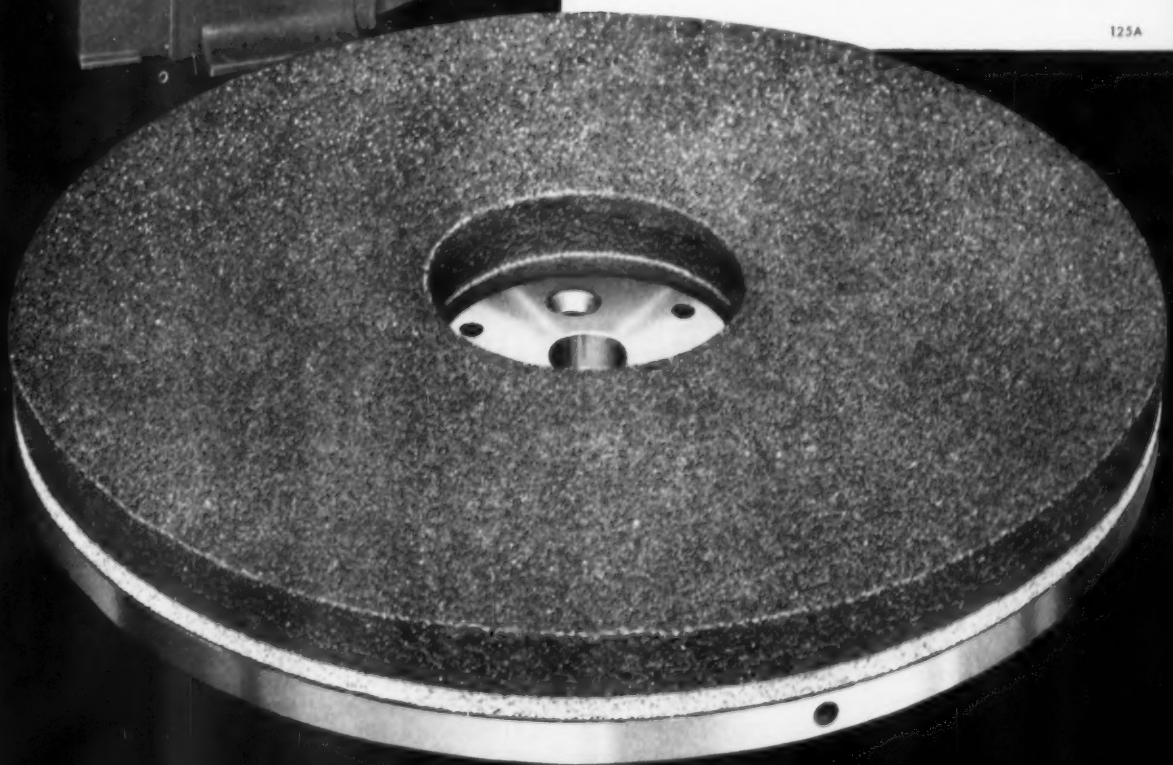
Grizzly Manufacturing Division grinds 5½ times more brake lining per disc

An 80% cut in abrasive disc costs in grinding brake lining is reported from Grizzly Manufacturing Division of Paulding, Ohio.

Looking for ways to cut costs, their production men called in the Gardner Abrasive Specialist. Could Gardner make discs that wouldn't wear out so quickly?

The new Gardner disc stepped up production from 454,790 to 2,512,200 feet of lining per disc. That's 5½ times more production for each disc! Downtime for disc replacement has been turned into productive time.

125A



GARDNER

abrasive discs

BELOIT, WISCONSIN, U.S.A.

ARMSTRONG

The ARMSTRONG Threading Tool takes interchangeable high speed steel form-cutters which require only flat top grinding to resharpen—always hold their true thread form.

Write for catalog

Each year ARMSTRONG TOOL HOLDERS become more important to you

Every rise in labor costs, every added tax, every overhead burden, every increase in cutting steel prices, every new, more costly machine tool, all increase the importance of ARMSTRONG TOOL HOLDERS to profitable operation.

ARMSTRONG TOOL HOLDERS reduce direct tooling costs to an absolute minimum—"Save: All Forging, 70% Grinding, 90% High Speed Steel."

ARMSTRONG TOOL HOLDERS reduce tooling-up time to minutes, to the selection and adjustment of the holder and cutter.

ARMSTRONG TOOL HOLDERS permit increased speeds and feeds—produce more pieces per hour per machine tool.

ARMSTRONG TOOL HOLDERS are efficient for they embody a perfection gained by over 50 years of specialization in the development and refinement of tool holders.

ARMSTRONG TOOL HOLDERS are inexpensive because they are quantity produced by modern methods, for a world market . . . are used by over 96% of the machine shops and tool rooms . . . are carried in stock for your convenience by all industrial distributors of consequence.

Buy ARMSTRONG TOOLS from your Industrial Distributor

ARMSTRONG BROS. TOOL CO. "The Tool Holder People" 5215 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

Q. What's new in grinding?

A. B-11 resinoid-bonded wheels —for many grinding jobs

Q. What's new about B-11 wheels?

A. Their great new resinoid bond, improved uniformity and balance, new "TOUCH of GOLD" performance-benefits

Q. What is the B-11 bond?

A. It's the latest Norton resinoid bond. Wheels made with it are excellent for snagging, disc grinding, heavy weld grinding, thread grinding, cam grinding, centerless grinding, roll and surface grinding.

Q. Why?

A. Because B-11 wheels are more uniform in structure, with better balance. As a result, they grind cooler and faster. And on portable machines they "hug that work" closer, with less vibration and bounce.

Q. What about those "Touch of Gold" benefits?

A. They're the direct result of the B-11 wheels' more efficient grinding action. In precision grinding this means improved surface finish, greater accuracy, more pieces per dressing. In rough grinding it means less operator-fatigue and longer wheel life. All these benefits add up to more profitable grinding for you.

Q. Any other advantages of B-11 wheels?

A. Many others. For example you get closest possible duplication. Hardness increments are evenly spaced throughout the entire grade scale. And B-11 wheels can be supplied in half-grade increments, making it even easier for you to choose exactly the right wheel for every job.

Q. Sounds fine — what about more information?

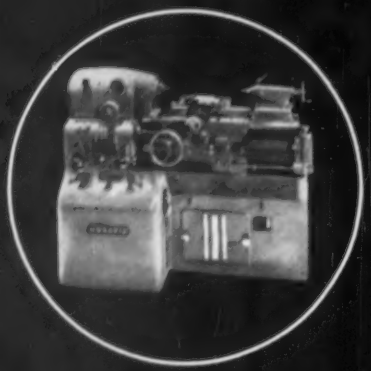
A. Your Norton Distributor will gladly give you the whole story on the new B-11 wheels. Or write us direct. NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

W-1778

NORTON
ABRASIVES

Making better products... to make your products better

NORTON COMPANY: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING DIVISION: Coated Abrasives Sharpening Stones • Pressure-Sensitive Tapes



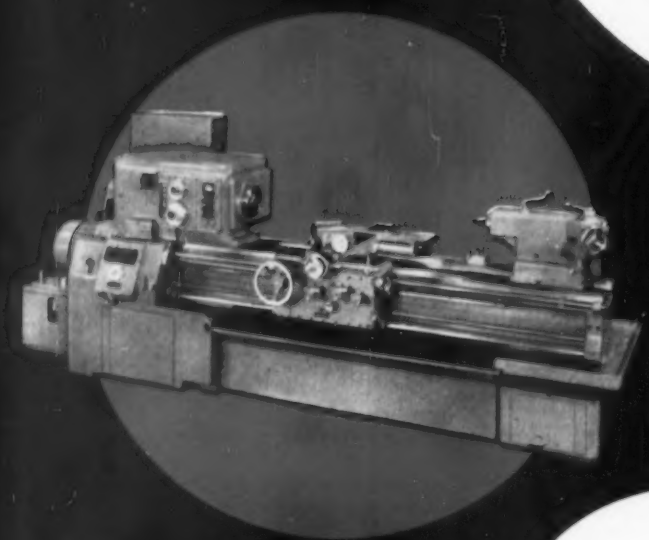
10" Model EE
Sensitive Precision
Toolmakers Lathe

What's your spot? —

Monarch Lathes are used successfully and widely in

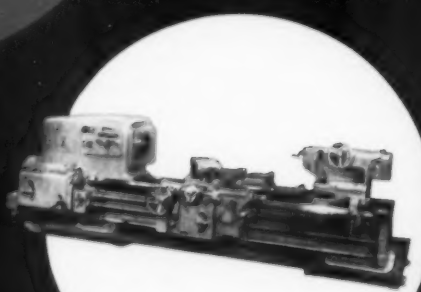
Maintenance Departments
Toolrooms
Experimental Shops
New Development Laboratories
Small Machine Shops
(special equipment for your plant)

in addition to direct large and small lot manufacturing operations.



Series 62
Pre-Selector
Dyna-Shift Lathe

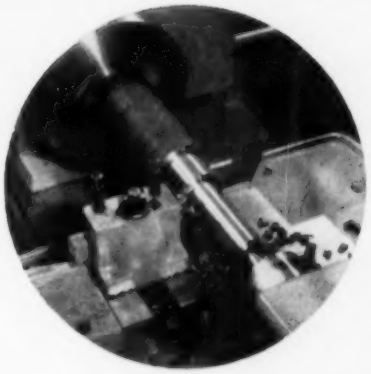
Series 90
Heavy Duty
Dyna-Shift Lathe



Series 61
Engine Lathe

THERE'S A SPOT FOR MONARCH LATHES

wherever metal is turned



And "wherever" is in many industries such as these!

Beverages	Optical
Buttons	Paper
Carpet	Plastics
Cement	Publishing
Chemical & Dye	Rubber
Confectionery	Soap
Drugs	Sugar
Foods	Textiles
Glass	Tile
Lumber	Tobacco
Mining & Refining	Transportation
Motion Picture	Utilities
Oil	

Yes, when it comes to keeping the wheels of the basic process and service industries turning, Monarch lathes play as vital a role as they do in the metal turning industry's toolrooms and production lines. Here, their job is to keep other machines functioning without failure, at a profit. Or to serve in their improvement.

So the same qualities that make all Monarch lathes first choice in the production turning field make many Monarch models equally important to almost every industry regardless of product. You want economy of operation, high degree of accuracy, utter reliability, bold engineering. You'll find all this in the Monarch models pictured here—and others . . . . . **The Monarch Machine Tool Company, Sidney, Ohio.**

Monarch
TURNING MACHINES

For All Users Monarch Lathes Offer These Advantages

1. Built-in versatility for a wide variety of turning, boring, facing and threading operations.

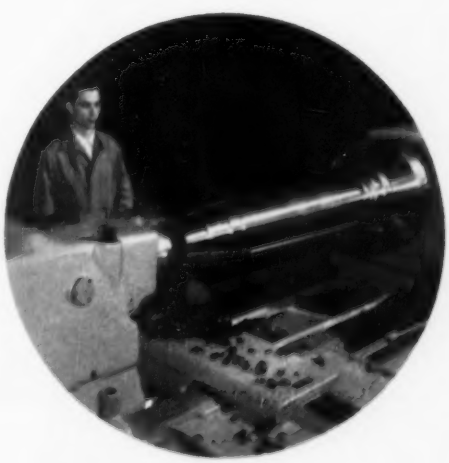
2. A vast selection of supplementary equipment for unusual or difficult work requirements.

3. High speed for the efficient handling of *all* work within the capacity of each machine.

4. Power for heavy cuts *plus* fingertip speed control to assure maximum tool life on all cuts.

5. Long, trouble-free life based on sound design and on manufacturing techniques which have served industry well since 1909.

6. Accuracy of performance which can come only from one of the world's most modern machine tool plants whose only purpose is and always has been to produce the finest in precision lathes.



now you can BROACH one complete

on this new LAPOINTE horizontal BROACHING MACHINE

Broaching 10 times faster than conventional type horizontal machines, this new LAPOINTE horizontal machine, with electro-motive drive, broaches a 25-tooth sprocket in *exactly 60 seconds!* Accurate, too — holding a tolerance within .002".

Built heavy and rugged for amazingly smooth operation, and capable of broaching-speeds up to 300 feet per minute, it's a "natural" for *carbide tooling.*

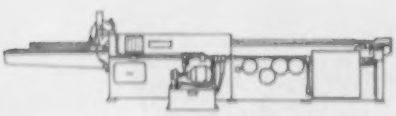
This machine can also be adapted to broaching GEARS, and CIRCULAR SAWS; and similar parts with repetitive form on the periphery. Doesn't all this give you an idea for using this broaching machine to solve some of your troublesome production problems? One of our experienced sales engineers will gladly discuss the subject with you . . . a request for information will bring a prompt reply.

THE LAPOINTE MACHINE TOOL COMPANY

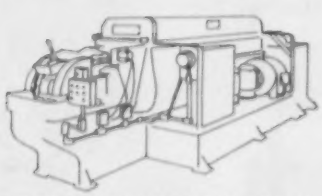
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

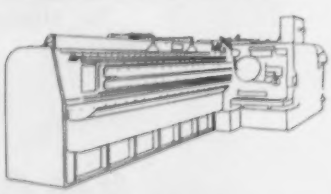
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC

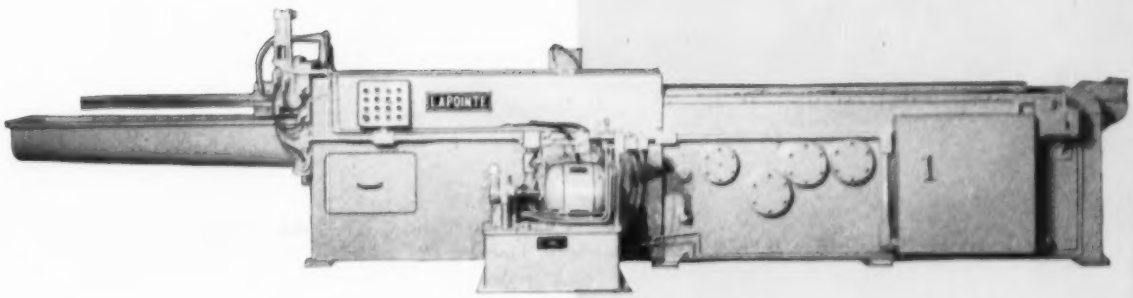


SRHE SINGLE RAM HORIZONTAL, ELECTRIC

sprocket per minute

with electro-motive drive

Pulsation-free, and broaching at uniform speed regardless of load, this newest LAPOINTE Broaching Machine with electro-motive drive, 60-inch stroke, broaches sprockets 2-at-a-time, at a broaching speed of 150 feet per minute.

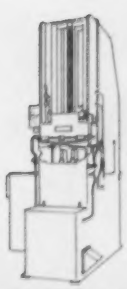


LAPOINTE *takes all the responsibility for your broaching program. We build the broaching machines, build the broaching fixtures, and make the broaches!*

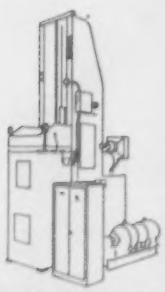
Change Gear Fixtures are available for broaching sprockets in a series of ranges from

- 4" to 20" diameter
- 18 to 112-tooth sprockets
- ⅜" to ⅝" pitch

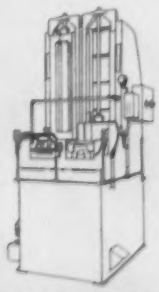
Fixtures and tooling can be provided for larger sprockets and a greater number of teeth.



VUB-7 VERTICAL PULL-UP ELECTRIC



SRVB SINGLE RAM VERTICAL, ELECTRIC



DRVB DOUBLE RAM VERTICAL, ELECTRIC

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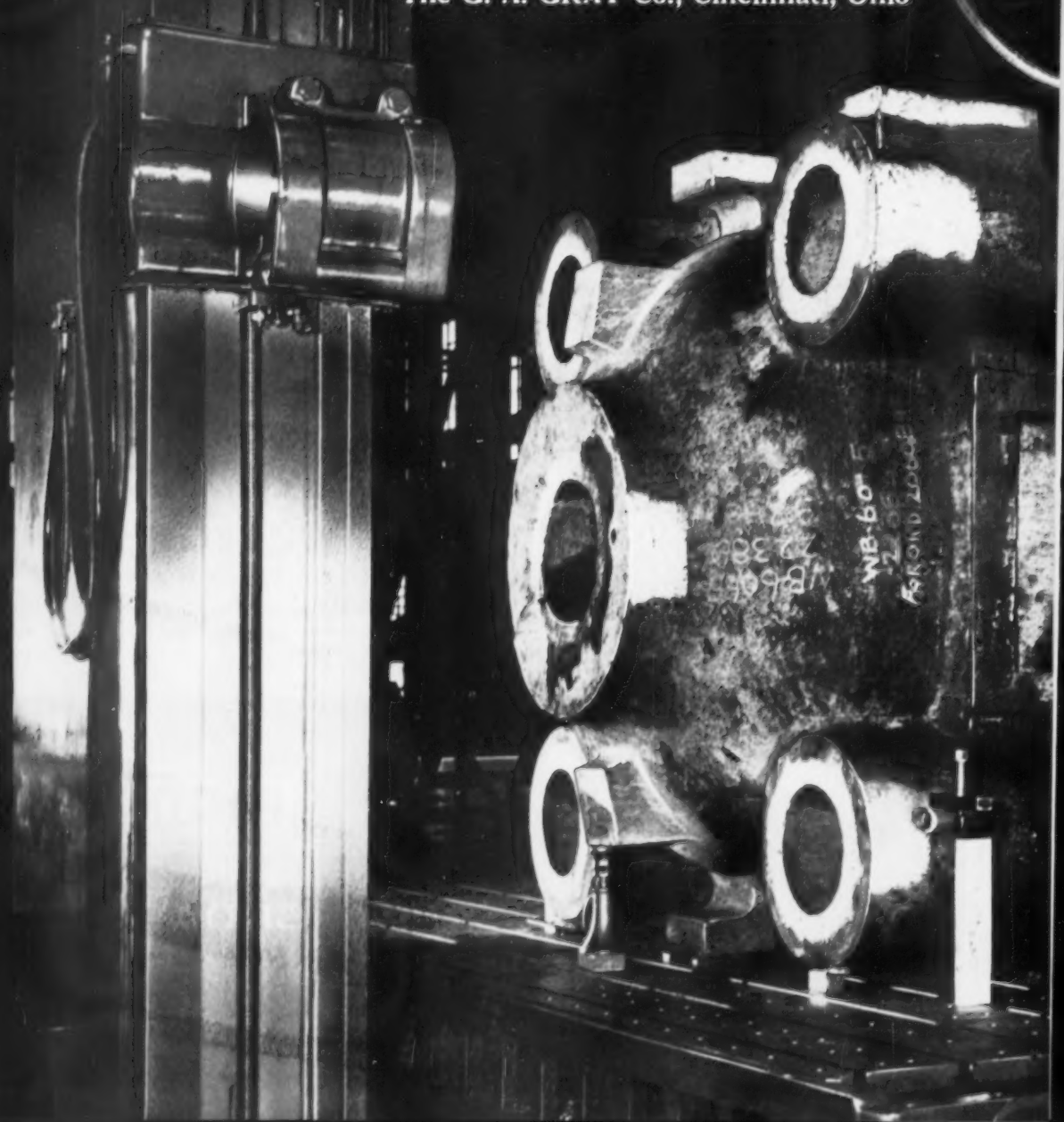
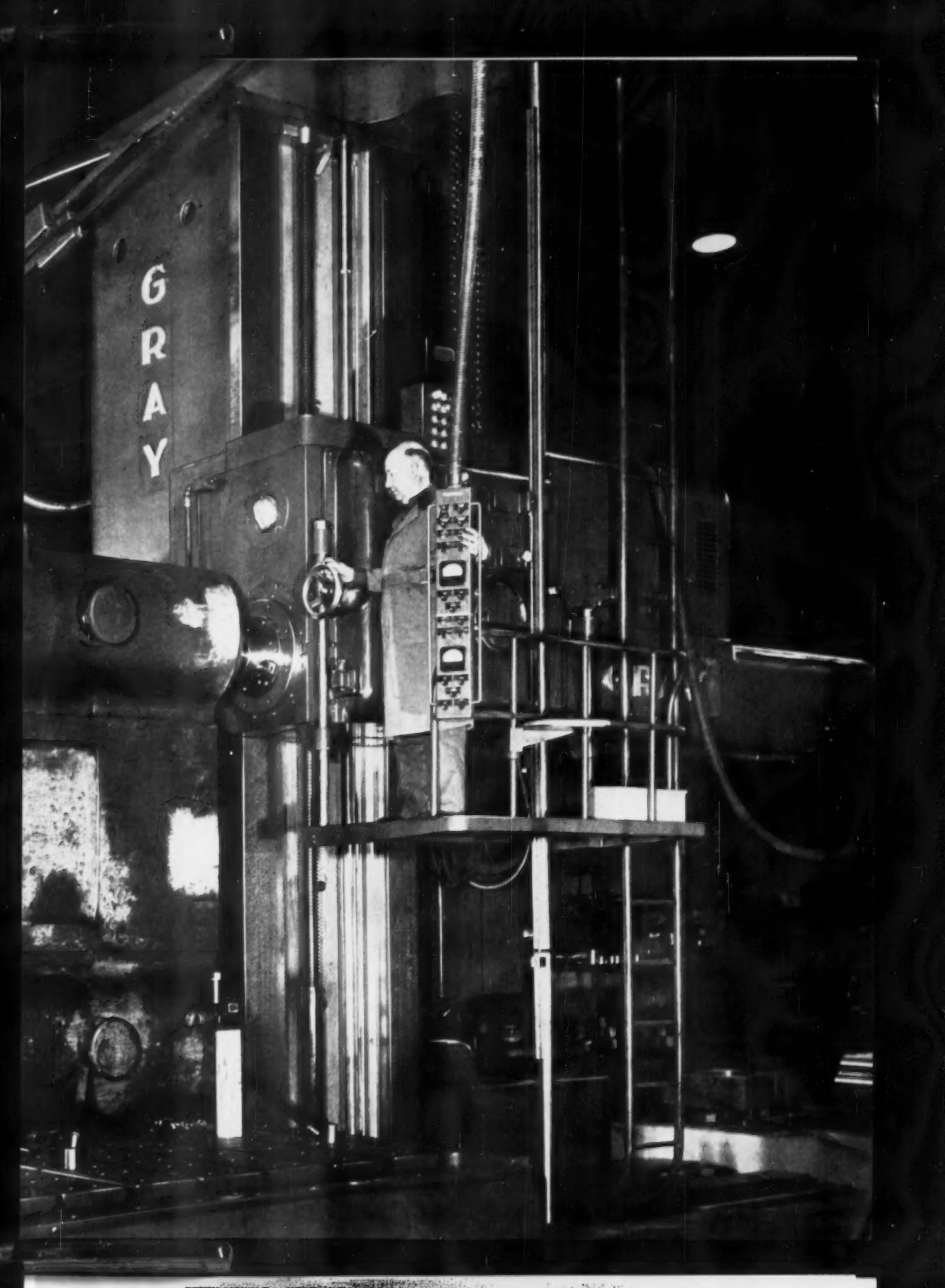
Its massive design and tremendous rigidity guarantee heaviest
carbide milling. Magically, precision boring to minute
tolerances is equally available on this 8″ Gray Horizontal.
Its amazing convenience permits small machine speeds
for the first time in the elephant field.
That's why . . . large jobs don't grow old on a Gray.

The G. A. GRAY Co., Cincinnati, Ohio

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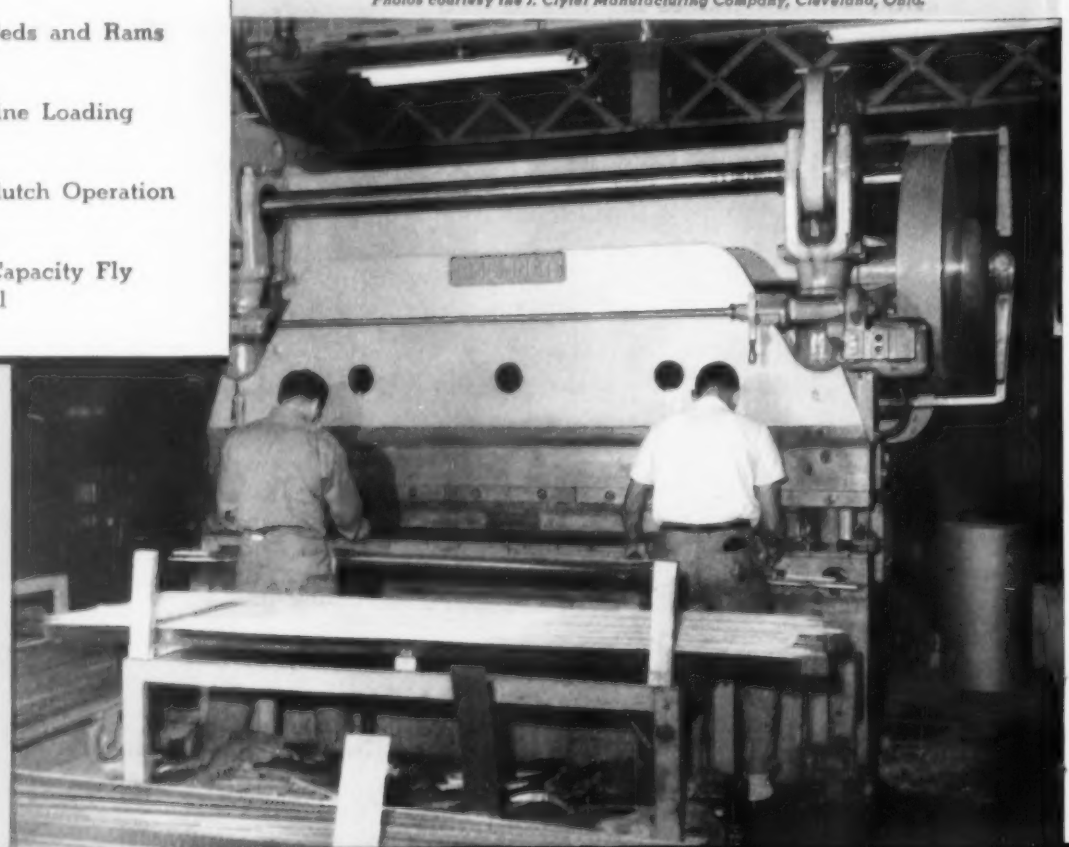
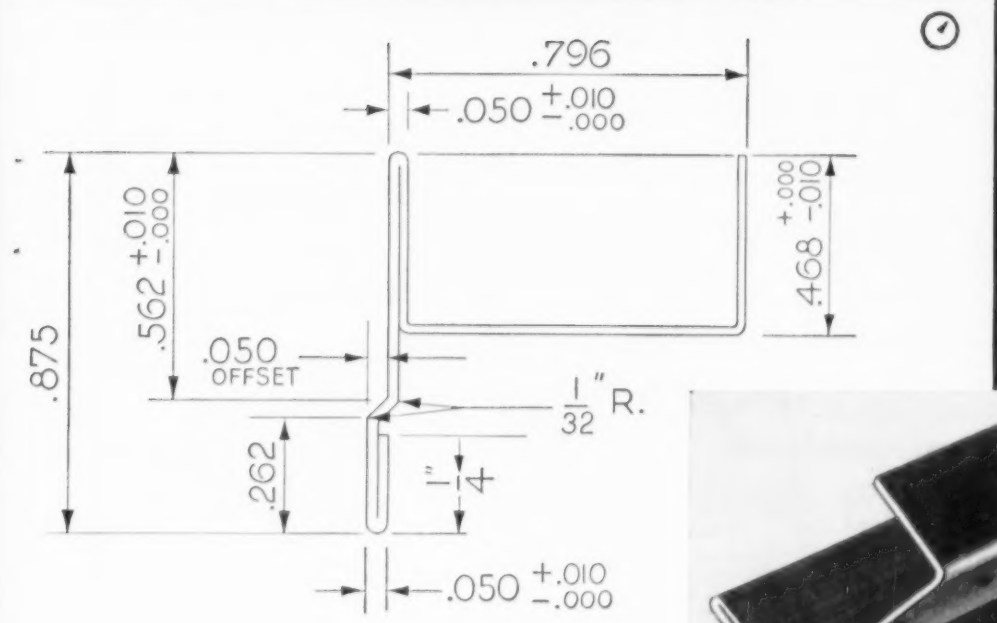
. . . at THE J. CLYTEL MANUFACTURING COMPANY

Metal Fabricators

CLEVELAND, OHIO

Photos courtesy the J. Clytel Manufacturing Company, Cleveland, Ohio.



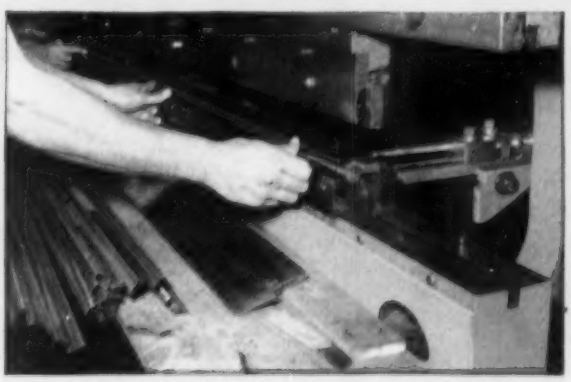


These galvanized steel channels for sliding window frames must be formed straight and true, and all dimensions held to close tolerances.

The Clytel Company say: "Our press room feels that only Cincinnati makes Press Brakes."

Consult our engineering department on your forming problems.

Write for comprehensive Brake Catalogue B-4.



One of the efficient die set-ups used on this job

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CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

See this "Show-Case" of VEEDER-ROOT COUNTERS...

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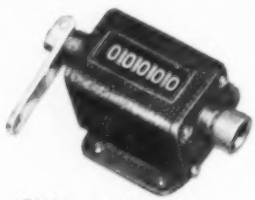
Insist on Standard VEEDER-ROOT COUNTERS

from your Industrial Supply Distributor or write us on special problems

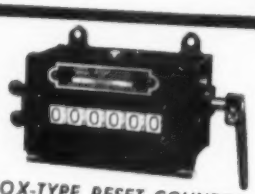


SMALL RESET COUNTER

A compact, rugged reset counter for moderate duty in parts inspection, quality control, conveyors, machine tools, light presses, etc.

Dimensions: 1¾" long, 1 15/16" high, 1 1/16" wide

Speed: Up to 1000 counts per minute.



BOX-TYPE RESET COUNTER

For punch press installations, conveyors, metal-working equipment, die casting, plastic-molding, rivet, spring and wire machining, or any installation requiring a heavy duty counter.

Dimensions: 4¼" long, 2 1/32" high, 3⅜" wide.

Speed: 500 counts per minute.

RESET MAGNETIC COUNTER

For remote indication of machine operation from plant to office.

Dimensions: 3 1/16" long, 2½" high, 1¾" wide.

Speed: Up to 1000 counts per minute.

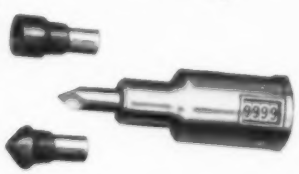
Coils: 110V-AC are standard. Other voltages are available. Panel mounting feature also available.

HAND TALLY

For quick spot-checks of production or performance.

Dimensions: 1 11/64" long (to end of reset knob), 1¾" deep, 2" high.

Counts one for each depression of the thumb lever, and resets to zero by a turn of the knob.



CLUTCH SPEED COUNTER

For checking to make sure that the machine is operating at the required R.P.M.

Dimensions: 3¼" long, ⅞" max. diameter. Non-Reset.

Internal clutch operates counter only when rubber tip is pressed against the shaft.

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Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

HOW THIS RAM TYPE TURRET LATHE WENT AUTOMATIC

Hydraulic Drive Gives Maximum Production with Minimum Operator Attention

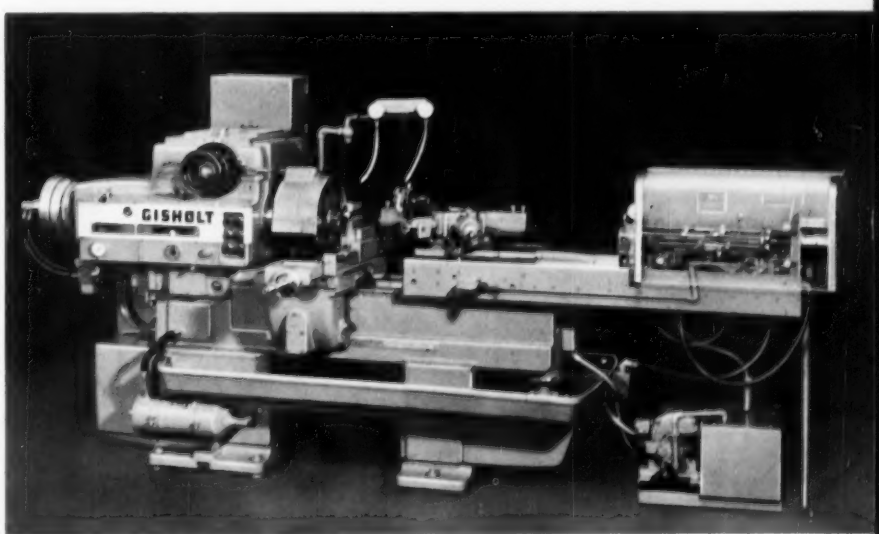
This appliance manufacturer was quick to take advantage of the possibilities of the new Gisholt MASTERLINE Ram Type Turret Lathe. By using two Gisholt No. 4 machines with automatic hydraulic drive, he put production of kitchen disposal unit parts on an automatic basis.

Here's how one of the parts—a cast iron flywheel—is handled. The workpiece is held in a two-jaw air chuck, through two holes cast in the face. The work locates against the back face, with spring-loaded pins eliminating vibration. The following operations are performed automatically, including necessary spindle speed changes: hexagon turret tools turn B, face D-F, form relief E, and drill, bore and tap G. At the same time, tools on the rear of the cross slide straddle-face A-C. Floor-to-floor time: 1.75 minutes. Similar machining operations at both ends of cast iron housings are also handled on these machines.

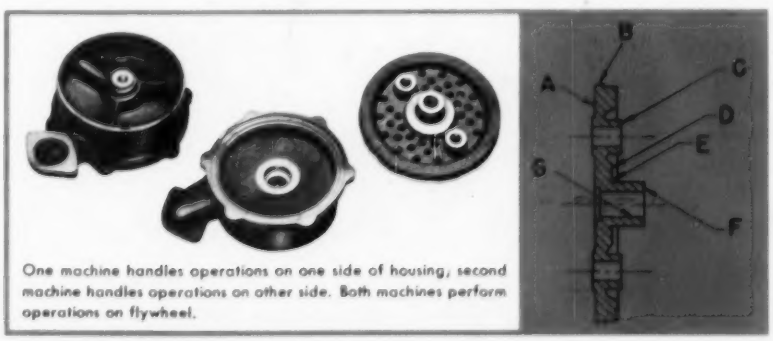
This hydraulic drive unit is equally efficient on long or short runs, with average setup time of only 1.4 hours for a fully tooled hexagon turret and two cross slide tools.

Easily adapted to any new Gisholt MASTERLINE Ram Type Turret Lathe, the hydraulic drive unit provides full automatic cycle with automatic spindle start and stop, reverse for threading... selection of any spindle speed for each station... fast approach, feed and return of turret... and infinitely variable feeds for better finish and closer tolerance work. The cross slide operates automatically in both directions.

Equipping a standard ram type turret lathe with automatic hydraulic drive boosts production and reduces need for close attention, skill and effort from operator.



General machine view showing hydraulic drive mounted on standard ram type turret lathe. Controls are simple, conveniently placed, and easily set up and adjusted. For complete information on hydraulic drive, ask for Form 1182. Bulletin 1174-B describes MASTERLINE Ram Type Turret Lathes.



One machine handles operations on one side of housing, second machine handles operations on other side. Both machines perform operations on flywheel.

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

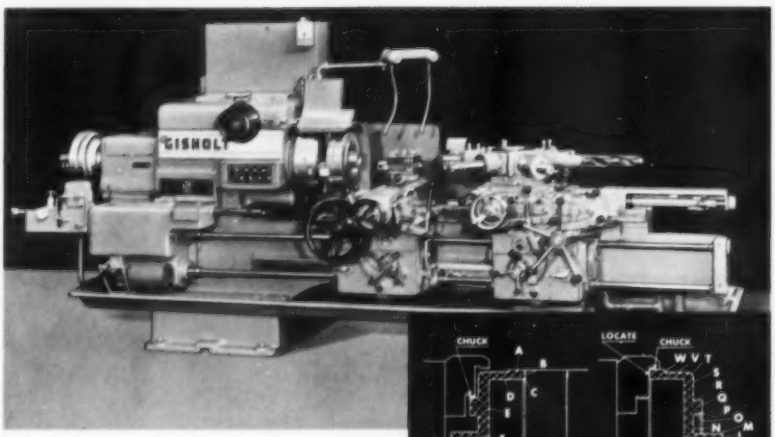
POWER, SPEED, VERSATILITY LICKED THIS JOB

How Smart Tooling Combined with Cross Feeding Hexagon Turret Shorten Change-Over Time

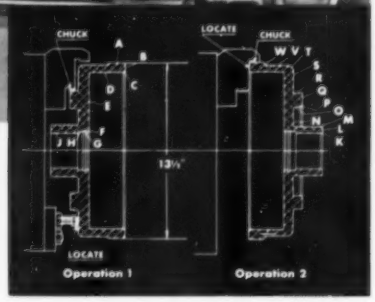
This job would be difficult with a machine less capable than the 1L Saddle Type Turret Lathe. Instead, the workpieces—aluminum air cylinder bodies—are machined in two fast operations. Heavy cuts are handled easily by the husky 30 h.p. motor, and spindle speeds up to 1850 r.p.m. help assure a fine finish on all surfaces machined.

Special two-step chuck jaws are used. Serrated steps grip at R for the first operation and plain steps chuck on A for the second operation. Tooling for both operations is mounted on the cross feeding hexagon turret. For change-over, one tool is removed and two new tools are added on the square turret.

During the first operation, A-B-C are handled from the square turret with D-E-F-G-H-J machined from the hexagon turret. Floor-to-floor time: 7.8 minutes.



Second operation tooling and workpiece. Multiple diameters easily handled by standard tools mounted on cross feeding hexagon turret.



Cross sectional view shows surfaces machined in first and second operations.

For the second operation, square turret tools machine K-L-P-Q-S-T-V-W. A single tool on the cross feeding hexagon turret is used to turn M, plunge N-O and turn R, completing the part. Floor-to-floor time on this job: 5.5 minutes.

Special chuck jaws and carefully planned tooling on the hexagon and square turret simplify change-over.

HOW BRITISH AUTO BUILDER SUPERFINISHES CRANKSHAFTS

Modern Process Replaces Former Grinding Operation

Owners of Morris autos are getting smoother, lower-cost engine operation these days—because of a Gisholt Model 56 Single Spindle Crankshaft Superfinisher. It is interesting to note how Morris Motors, Ltd., of Coventry, England, is handling the job.

Gisholt Model 56 Crankshaft Superfinisher in operation at Morris Motors, Ltd.

The crankshafts are centralized on the flange O.D. and supported with a center at the pulley end. Longitudinal location is against the face of the flange, and drive is taken from a hole in the flange.

Both the main and pin bearings are Superfinished simultaneously. Stone pressure is adjustable for each main or pin bearing. During the automatic cycle, the workpiece rotates and reciprocates as the stones engage the work. Crankshafts come to the Superfinisher with bearing surfaces of 30 to 40 micro inches. These are Superfinished down to 10 micro inches or less, with 35 parts an hour handled at 80% efficiency.

By Superfinishing, this auto builder cuts grinding costs on crankshafts—and gets smoother surface and improved geometry for finer performance and longer wear.

GISHOLT

LOOK AHEAD... KEEP AHEAD... WITH GISHOLT

GISHOLT

TIME-SAVING IDEAS

MODERN BALANCING MADE FASTER, EASIER

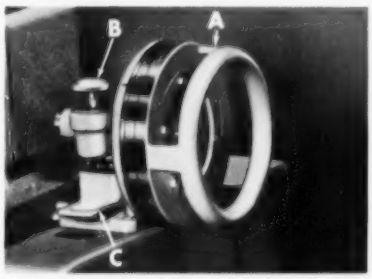
Amount Meter Reads in Terms of Correction Method Employed for the job

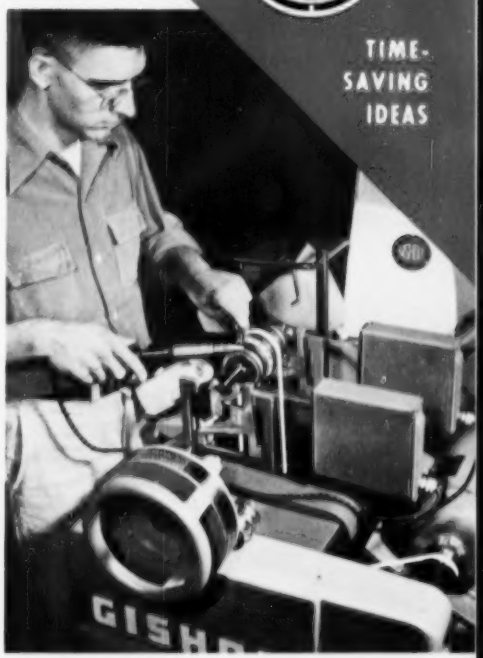
It's a proven fact: for maximum efficiency in handling small electric motor armatures or similar parts, a balancing machine must indicate directly the amount of alteration or correction required—and the exact angular location of unbalance—in each of two correction planes.

By using a direct reading amount meter, Gisholt Balancing Machines are providing these indications more quickly and in terms easily understood by any operator. Because Gisholt uses electrical means to locate and measure unbalance effects, it is a simple matter to adjust the amount meter to read in correction units most practical for the work.

On this job, the correction unit is a length of solder. The Gisholt 1S is equipped with a metering device with which the length of solder is quickly measured and cut off. Handwheel A is turned to a number corresponding with the observed meter reading. As plunger B is depressed, the amount of solder required for correction is cut off and deposited in tray C. The operator is shown applying the metered length of solder to make the balancing correction. Workpieces like this are balanced and corrected in less than one minute floor-to-floor time.

Production balancing time is sharply reduced by Gisholt Balancers' ability to indicate unbalance in terms of practical correction units. Direct reading—plus metering device—eliminates need for charts, graphs and translating data.





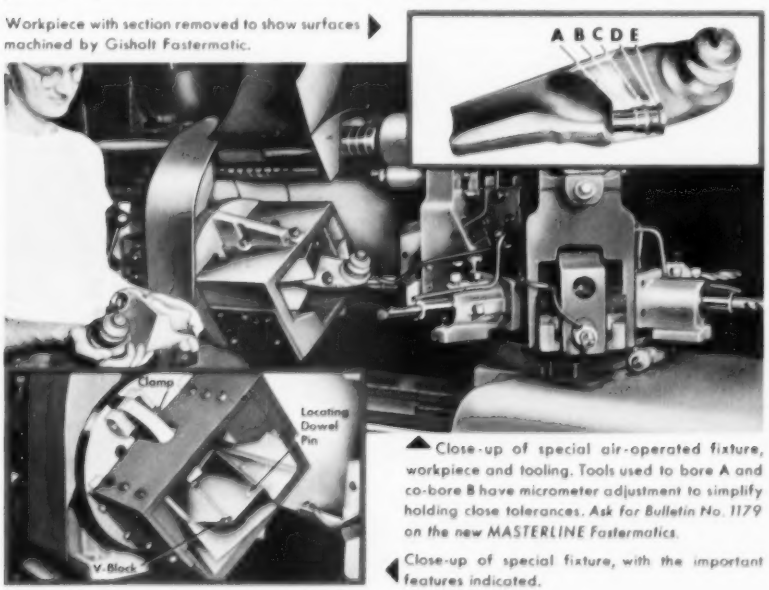
Operator uses soldering iron to apply metered length of solder at the angle indicated in each correction plane. Close-up shows metering device which provides measured length of solder.

SPECIAL FIXTURE SIMPLIFIES MACHINING OF ODD-SHAPED PARTS

Automatic Machine Cycle Improves Accuracy, Reduces Operator Effort

Three forged steel jet arms, welded together, form the familiar oil well rock bit body. Each jet arm has a cutter mounting spindle and a high-pressure jet nozzle to flush material during drilling. Machining of this jet nozzle bore is complicated because its center line is different from the center lines of both the cutter mounting spindle and the welded rock bit body.

Workpiece with section removed to show surfaces machined by Gisholt Fastermatic.



▲ Close-up of special air-operated fixture, workpiece and tooling. Tools used to bore A and co-bore B have micrometer adjustment to simplify holding close tolerances. *Ask for Bulletin No. 1179 on the new MASTERLINE Fastermatics.*

◀ Close-up of special fixture, with the important features indicated.

In addition, the surface finish and bore tolerances are critical and must be closely held. Here is how this Gisholt 2F Fastermatic Automatic Turret Lathe was tooled to overcome these problems.

The workpieces arrive with two adjacent faces machined to form an angle of 120 degrees and with a hole drilled in one face for locating purposes. They are placed in a special air-operated fixture on a V-block insert, mating with the machined surfaces, locating the work on center. A dowel pin provides accurate longitudinal location. A pivot-type clamp holds the work on the shank O.D.

Machining is simple. Front and rear cross slides are eliminated to permit swinging the fixture. Hexagon turret tools bore A and co-bore B. Overhead stop actuated internal facing tools form C-D and E is chamfered to finish the job.

Floor-to-floor time on this 8¾" size jet arm is 4.2 minutes. Because several part sizes are handled, the V-block insert is replaceable, keeping change-over time at a minimum on this job.

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MASTERLINE
GISHOLT SINCE 1887

TIME-SAVING IDEAS

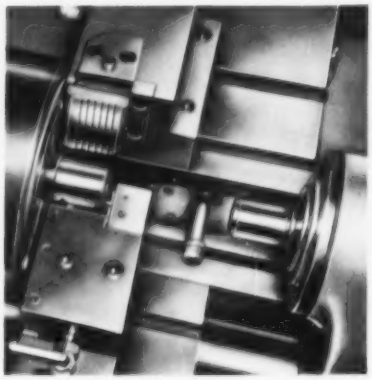
SMART SETUP PERFORMS TWO-SEQUENCE JOB IN ONE CHUCKING

Two-Speed Motor Provides Correct Spindle Speed for Each Operation

Here is a dramatic example of what you can do with the Gisholt No. 12 Automatic Production Lathe. You may get some ideas from the interesting tooling setup shown here in the photos.

Workpieces are 2" welded pipe stems made from steel tubing. Parts arrive cut to rough length and threaded at one end. They are placed in an air-operated collet chuck, located against the threaded end and chucked on the unmachined O.D.

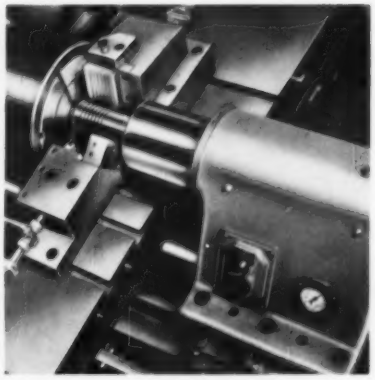
For the first part of the job, spindle speed is 330 r.p.m. and the feed is .022". Tools on the carriage are fed longitudinally, turning the O.D., shave-facing to length and chamfering the interior of the bore. The carriage then reverse feeds to clear the chamfer tool, and moves transversely out of the way.



Turning, facing and chamfering are completed from front carriage. Note tailstock is retracted.

The air-operated tailstock advances automatically to support the part in the chamfered bore. Spindle speed drops to 82 r.p.m. and the feed to .005". O.D. radius and seven serrations on the tube are machined in a heavy forming cut from the rear independent slide. Floor-to-floor time for the complete job is only .6 minute.

Complex feeding motions of the front carriage are easily obtained and extra handling is eliminated, with all operations performed in a single chucking.

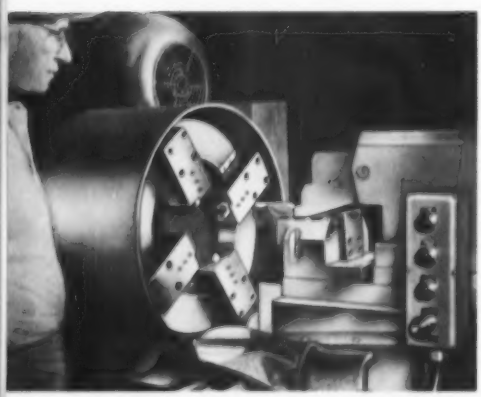


Tailstock supports during heavy forming cut made from rear independent slide.

Left to right—rough workpiece; after turning, facing and chamfering; completed part.

CURVED SURFACE GENERATED BY SPINDLE-MOUNTED TOOLS

Fixture Mounted on Platen Table Feeds Work into Tools



Close-up of work and tooling. Smallest workpiece handled is shown in fixture. Largest is on platen table in foreground.

This unusual arrangement permits machining curved surfaces on the ends of forged steel bit head sections at high production rates.

The machine is a Gisholt Simplimatic Automatic Lathe. Work is held in a V-block fixture mounted on the platen table, with the shank end locating against a dead stop. An air-operated clamp holds the part securely in place. The platen table traverses the work to the tools and changes to feed. The severe interrupted cut is divided between four tools mounted on a special face plate fixture. At the end of the cut, the base supporting the fixture is shifted, relieving the workpiece instead of the tools.

Several different sizes are handled. Diameters range from approximately 5¾" to 12". The smallest part requires .6 minute, and the largest 1.10 minutes floor-to-floor time. For fast change-over from one size to another, tool blocks are changed, V-block is replaced in fixture, inserts are changed in clamping jaw, and locating stop is adjusted.

Flexibility offered by platen table permits "reverse" tooling setup, allowing work to be fed into tools on the spindle. Tools are pre-set to further simplify this setup.

No. 5-656
655

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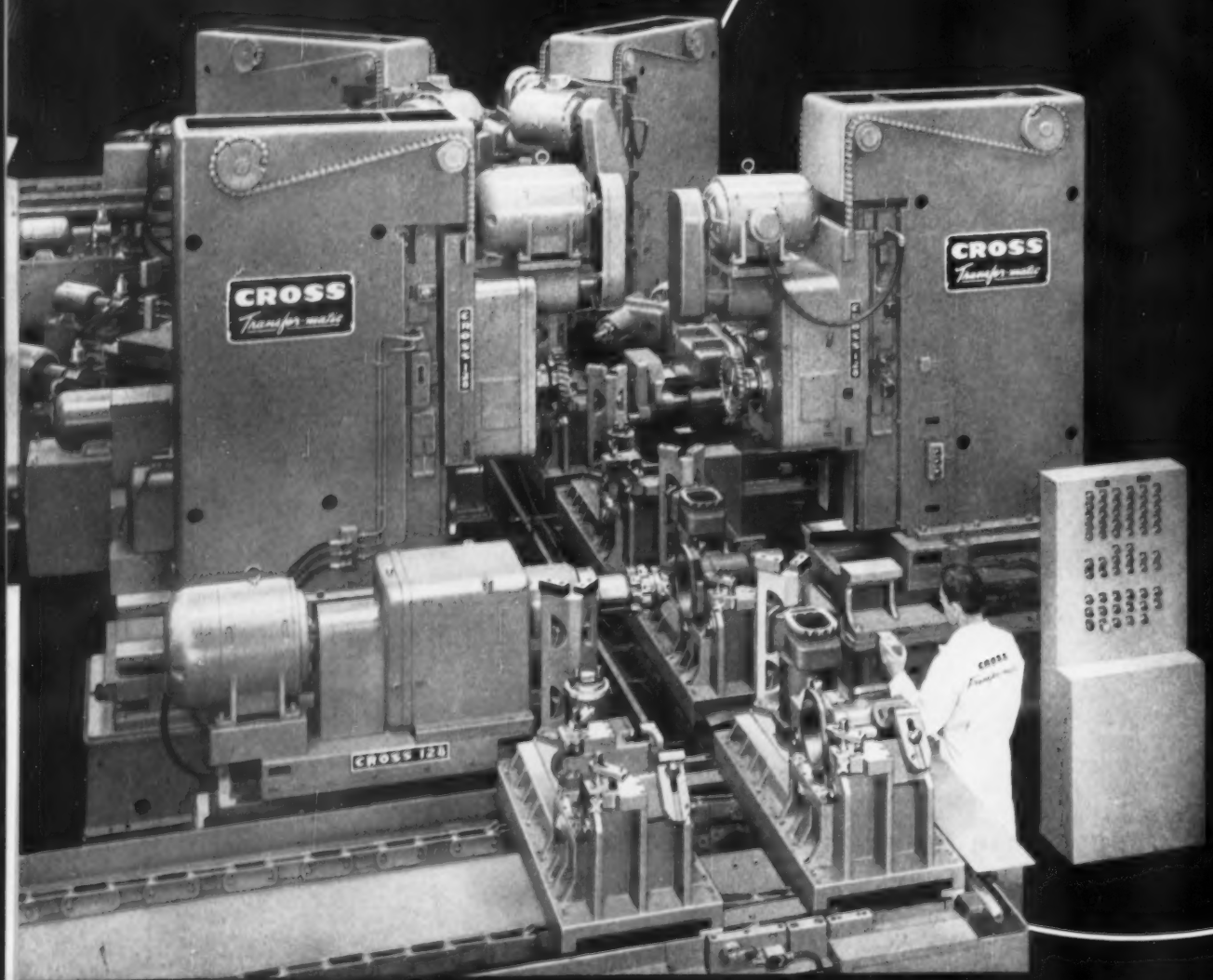
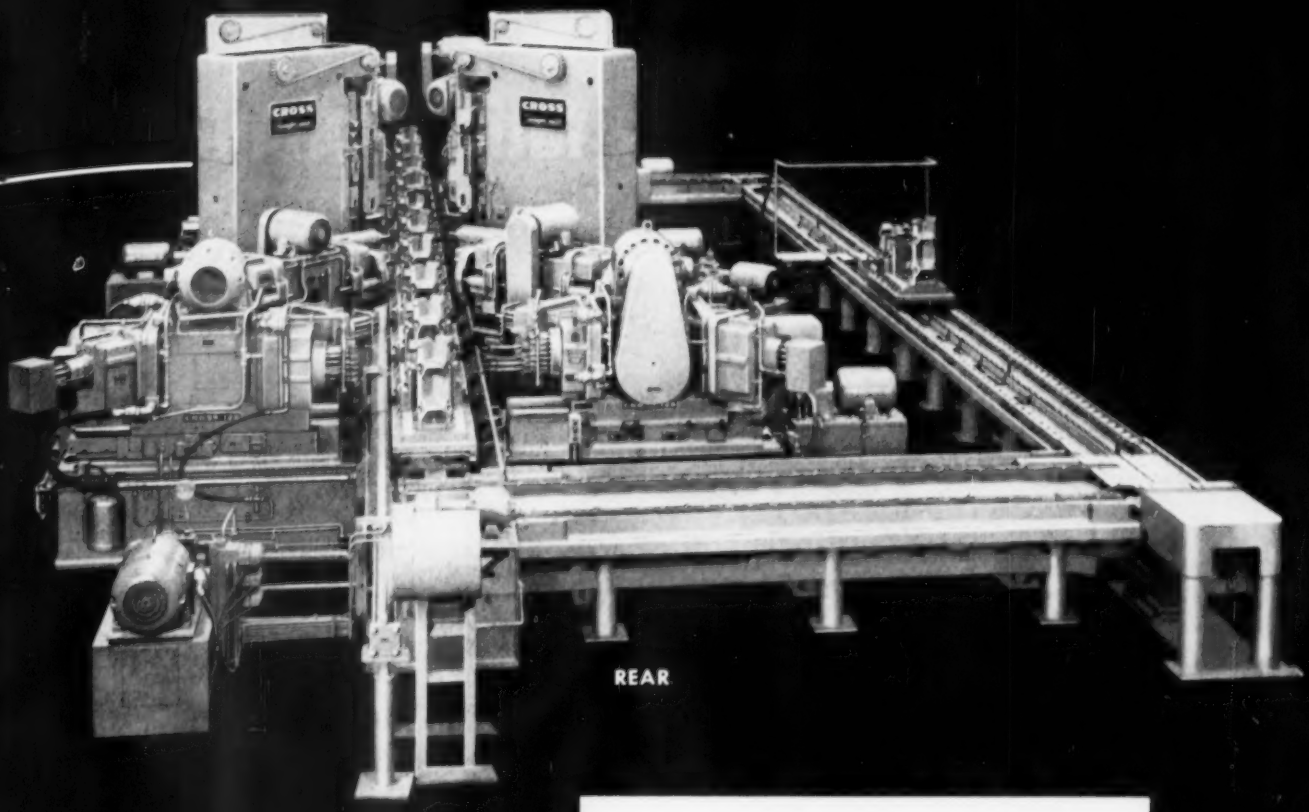
(from Rough Castings to Assembly)

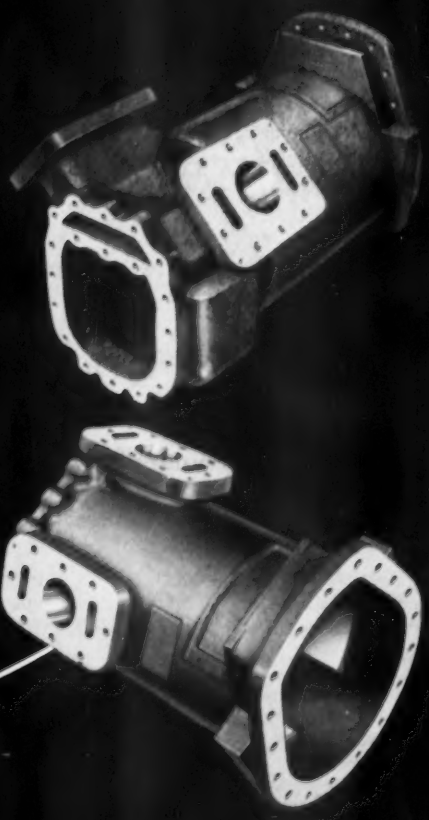
Another Transfer-matic by Cross



OPERATOR'S STATION



REAR



- ★ 18 pieces per hour at 100% efficiency.
- ★ 159 operations: 6 milling, 6 boring, 1 facing, 81 drilling and 65 tapping.
- ★ Two-position, progressive type, palletized work holding fixtures for carrying the parts from station to station.
- ★ Modular unit construction provides flexibility for part design changes.
- ★ All parts in Cross machines—even tooling details—are made to interchangeable tolerances for fast, easy maintenance.
- ★ Other features: Construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling and boring; individual lead screw feed for tapping; automatic lubrication; automatic chip conveyor.

Established 1898

THE CROSS CO.

First in Automation

DETROIT 7, MICHIGAN

International Products & Mfg. Co.

switched to La Salle **fatigue-proof** STEEL BARS

TO MAINTAIN UNIFORMLY HIGH QUALITY

International Products & Manufacturing Company is now specifying "FATIGUE-PROOF" steel bars for generator and starter shafts. These are heavy-duty shafts. Formerly they used 4140 or 8640 heat-treated.

Field failures can be anticipated unless the finest of materials and the best of manufacturing practice are employed.

"FATIGUE-PROOF," by eliminating heat-treatment, does away with any possibility of quench cracked shafts getting past inspection. Since no straightening after heat-treatment is required, unfavorable residual stress due to severe straightening operations cannot be present.

It's another case where "FATIGUE-PROOF's" high strength in-the-bar eliminates a possible cause of trouble.

If you want to improve the quality of your products and avoid the problems of machining or heat-treating parts from high strength carbon or alloy steels . . try a sample bar of "FATIGUE-PROOF." If you will give us application details, send a blueprint, or call La Salle Sales Engineer at REgent 4-7800, Chicago, Illinois, he will send you a test sample if it appears "FATIGUE-PROOF" can be used to your advantage.

International Products & Manufacturing Co., of Chicago, are manufacturers of automotive starter and generator parts.

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Please send me your "FATIGUE-PROOF" Bulletin.

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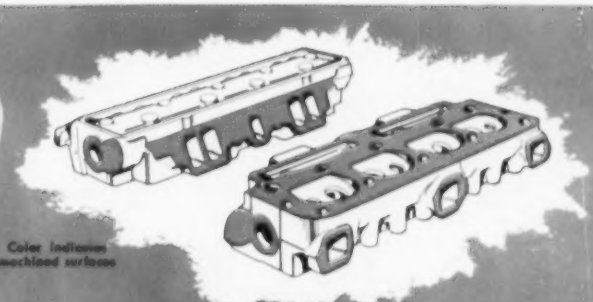
CUSTOMER SPECIFIED



A leading automobile company requested Kearney & Trecker's Special Machinery Division to design and build an automatic transfer machine to perform a series of milling and drilling operations on V-8 cylinder heads.

KEARNEY & TRECKER MILWAUKEE® DESIGNED

Kearney & Trecker built this 12-Station Automatic Transfer machine which rough and finish mills the head gasket surfaces, mills intake and exhaust port surfaces and both ends, and drills, counterdrills and reams two holes on each of two cylinder heads for V-8 engines. Machine's production rate is 100 pieces per hour.

The two cylinder heads progress automatically through the machine side by side, each on separate transfer rails. Transferring, locating, clamping, lubrication and chip disposal are all automatic.

For more information on machine illustrated, ask for Data Sheet No. 1080. A new bulletin, SMD-56, which describes many of our outstanding designs, is also yours for the asking.

Production efficiency starts with

Kearney & Trecker Milwaukee machine tools

This typical example reduced costs and meant higher production for the buyer. Kearney & Trecker's Special Machinery Division's 50 years' experience in machine design and manufacture can mean considerable savings to you.

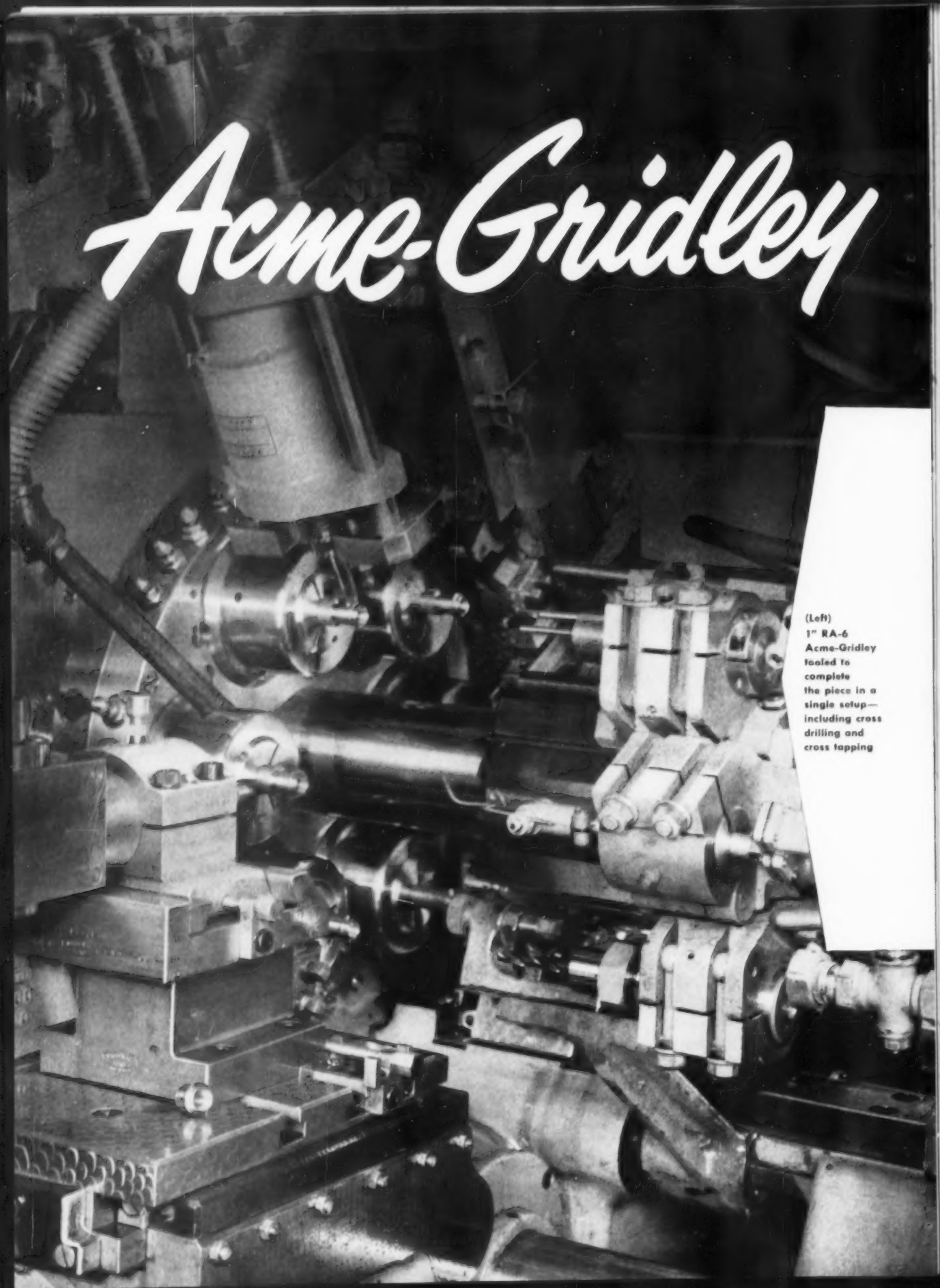
Take advantage of our abilities. They can pay off in profits for you. See or write your Kearney & Trecker Special Machinery Division representative. He will be pleased to give you all the details on this production machine. Contact him today!

Special Machinery Division

MILWAUKEE 14, WISCONSIN, U.S.A.

Designers and Builders of Precision and Production Machine Tools Since 1898

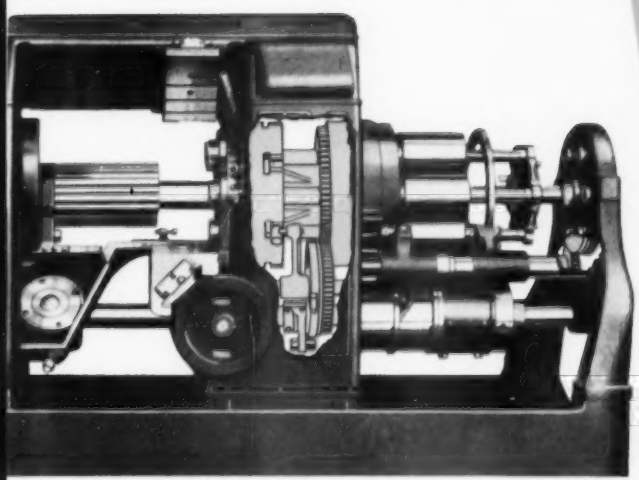
Acme-Gridley



(Left)
1" RA-6
Acme-Gridley
tooled to
complete
the piece in a
single setup—
including cross
drilling and
cross tapping

shockless indexing combined with independently-powered stock reel..

gives greater sustained accuracy... longer machine life



SHOCKLESS, POSITIVE INDEXING of the spindle carrier at high speed is accomplished by a Geneva mechanism. Indexing starts smoothly from a standstill, rapidly accelerates, then decelerates and comes to a dead stop without shock. Accurate location and positive locking of the carrier is assured by the locking pin mechanism.

STOCK REEL IS INDEPENDENTLY POWER INDEXED through a separate shaft and gear. This eliminates torsional strain and any tendency to whipping action, which might cause excessive wear on spindles and spindle carrier.

Acme-Gridleys are at their productive best when performing "secondary" operations during the primary setup—operations which otherwise would require additional time, machine investment, and floor space.

On an Acme-Gridley you can perform operations that require "on-the-button" indexing—such as cross-drilling and cross-tapping in successive spindle positions—with the same fourth-decimal-point-accuracy at the end of the shift as at the start.

And—your Acme-Gridley has power and stamina to spare, at the highest speeds and feeds that modern cutting tools can safely stand.

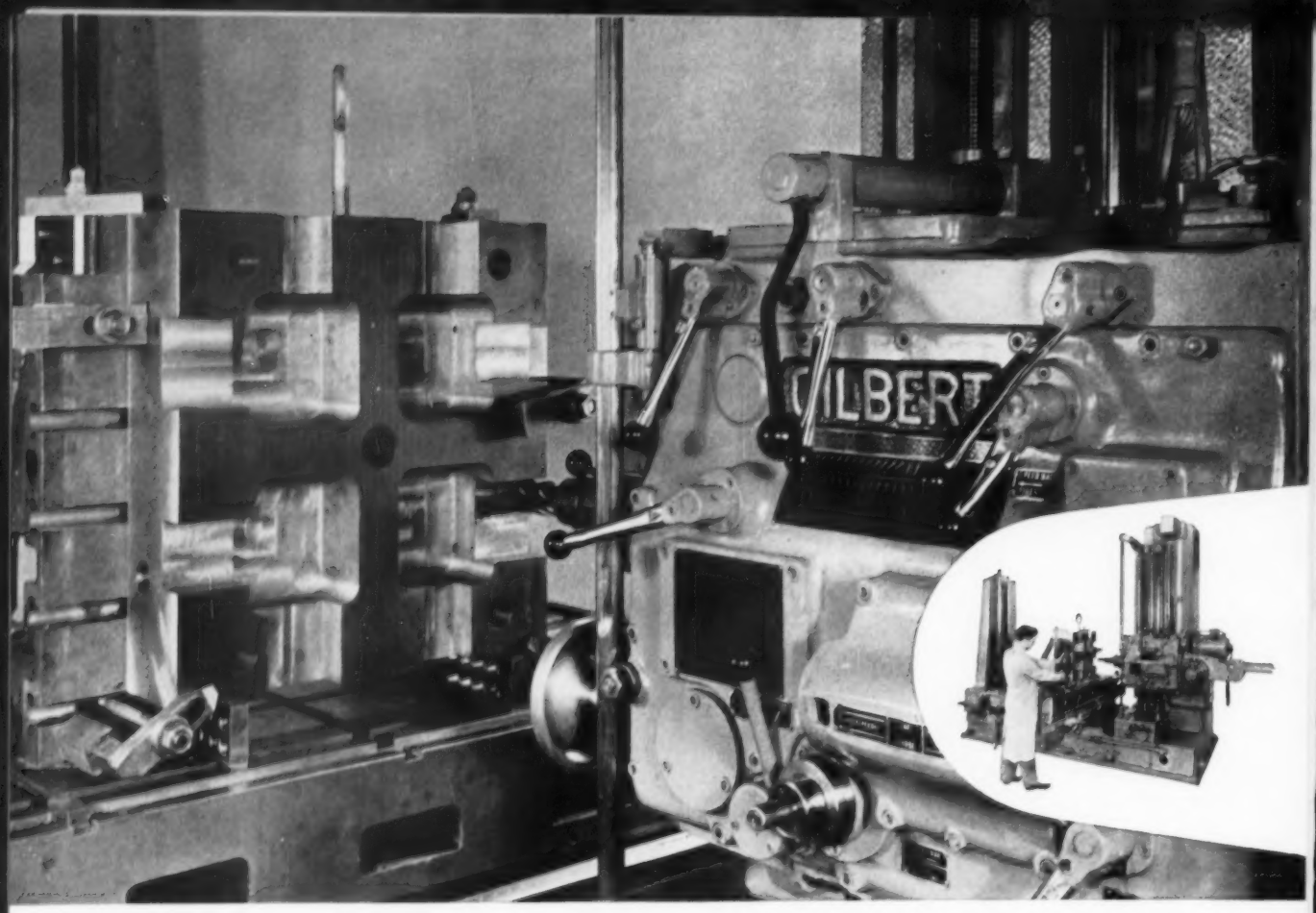
LET US TELL YOU MORE ABOUT Acme-Gridley BASIC DESIGN

This is but one of many BASIC DESIGN features which are responsible for Acme-Gridley's outstanding performance records. May we send you additional information? Or, better yet, let us send a representative to discuss possible production short cuts with you.

National Acme

THE NATIONAL ACME COMPANY • 171 EAST 131ST STREET • CLEVELAND 8, OHIO

SALES OFFICES: • Newark 2, New Jersey • Chicago 6, Illinois • Detroit 27, Michigan



courtesy Mohawk Tool & Die Corporation and Macaulay Machinery Co.

30 percent savings and ±.001"

...match it with a Gilbert

How's this for a perfect lineup: 30% savings in floor-to-floor time over previous machines, and ±.001" for mating the two chases of a four-cavity carburetor bowl mold.

Mohawk Tool & Die Corp., Rochester, N.Y., gets these savings and accuracy by handling the job on a Cincinnati Gilbert horizontal boring mill.

Here the lower chase (of hot work die steel) is being rough machined. Then it's hardened to a Rockwell of 48-50C scale. Finally, the chase is finish machined with carbide to an accuracy of ±.001" for guide pin and bushing holes, four cavity pockets, and eight slide ways.

Says Mr. George Neward, Mohawk's Secretary-Treasurer: "This job illustrates the flexibility of this type of machine. The ruggedness and stability of the Cincinnati Gilbert has been proven to us without doubt."

The comparatively low cost of adding these advantages to your operations will surprise you. Write for new literature, or—better yet—get a proposal from Gilbert now.

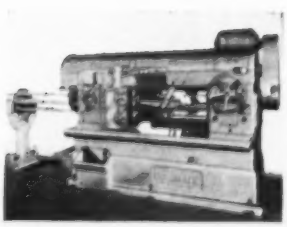
The Cincinnati Gilbert Machine Tool Co., 3366 Beekman Street, Cincinnati 23, Ohio

You can buy a new compound table type Gilbert horizontal boring mill on a 5-year payment plan for as little as $5580 down and $428.36 a month. This is $1.28 an hour on a two 8-hour-shift operation. Includes low 6% simple interest (3% add on).

those who buy Gilbert buy **GILBERT** *again*

If you haven't read this important booklet, your production line may be operating at less than peak efficiency. Your operations may be beating competition with HSS today, but you will likely need carbide tooling to be the leader tomorrow.

Write for your free copy of this important booklet today!



Conomatic

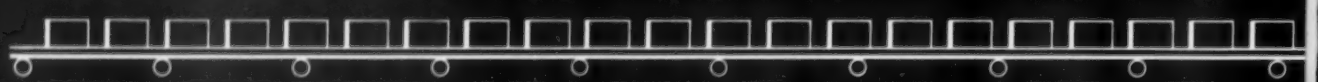
CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.

WHICH PRODUCTION PATTERN IS YOURS?

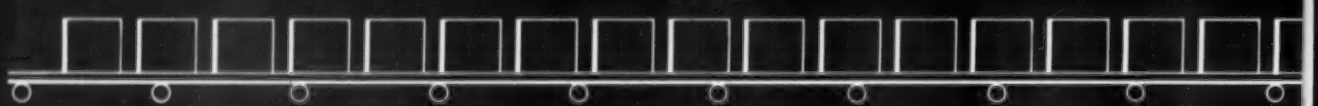
JOB LOTS—VARIETY OF SMALL PARTS

JOB LOTS—VARIETY OF LARGE PARTS

HIGH PRODUCTION—SAME SMALL PARTS



HIGH PRODUCTION—SAME LARGER PARTS



NOW . . . 4 NEW G-E INDUCTION HEATERS MATCH

You get maximum induction heater performance at minimum investment cost when you choose one of General Electric's new electronic induction heater models. Each model is tailored to one of the basic production patterns illustrated above. This lets you buy only the induction heating features you need for your particular production pattern.

In any one of the four ratings—7½-, 15-, 25-, 40-kw—you can choose a model to match your production pattern:

FOR HEATING SMALL AREAS the built-in output transformer is recommended. This feature enables you to couple power at maximum efficiency into a wide variety of low-impedance inductor coils.

FOR HEATING LARGER AREAS the tapped tank coil is recommended. The tap-adjustment feature lets you couple the heater power into a wide variety of high-impedance inductor coils.

FOR JOB-LOT PRODUCTION OF A WIDE VARIETY OF PARTS, variable power adjustment is recommended. Grid control of thyratron tubes permits manual adjustment of power under load from 0 to 100 per cent.

FOR HIGH-VOLUME PRODUCTION, IN WHICH YOU DO NOT HAVE RAPID CYCLING, the variable power adjustment feature is not needed. In these applications, the heater is adjusted initially to heat a specific part. No further adjustment is necessary until you change to a different part.

Features in any of the four ratings can be combined in the following fashion:

Model	Thyratron	Output Transformer	Tapped Tank Coil
4HM L1	x	x	
4HM L2		x	
4HM L3	x		x
4HM L4			x

Your nearby G-E Heating Specialist will help you choose the model best suited to your production pattern. You'll be paying only for those induction heater features you will use in your operation.

For specific bulletin information about these new induction heaters send in the coupon at the right.

GENERAL ELECTRIC

ANY PRODUCTION PATTERN . . . ECONOMICALLY

G.E. Gives You All These Features — and More!

DESIGN FEATURES	G.E.
High KVA Oscillator	
Built-in Water-to-air Heat Exchanger	
Readily Accessible for Maintenance	
Four Models in Each Rating	
Totally enclosed Aluminum Oscillator Box	
Dust-tight Cabinet Construction	
Industrial-type Oscillator Tubes	
Filament Voltage Regulation of ±3%	
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Three Instruments on Control Panel	

FREE BULLETIN
Section E722-4
General Electric Company
Schenectady 5, New York

Please send me a copy of your bulletin "New G-E Electronic Induction Heaters" GEA-6388.

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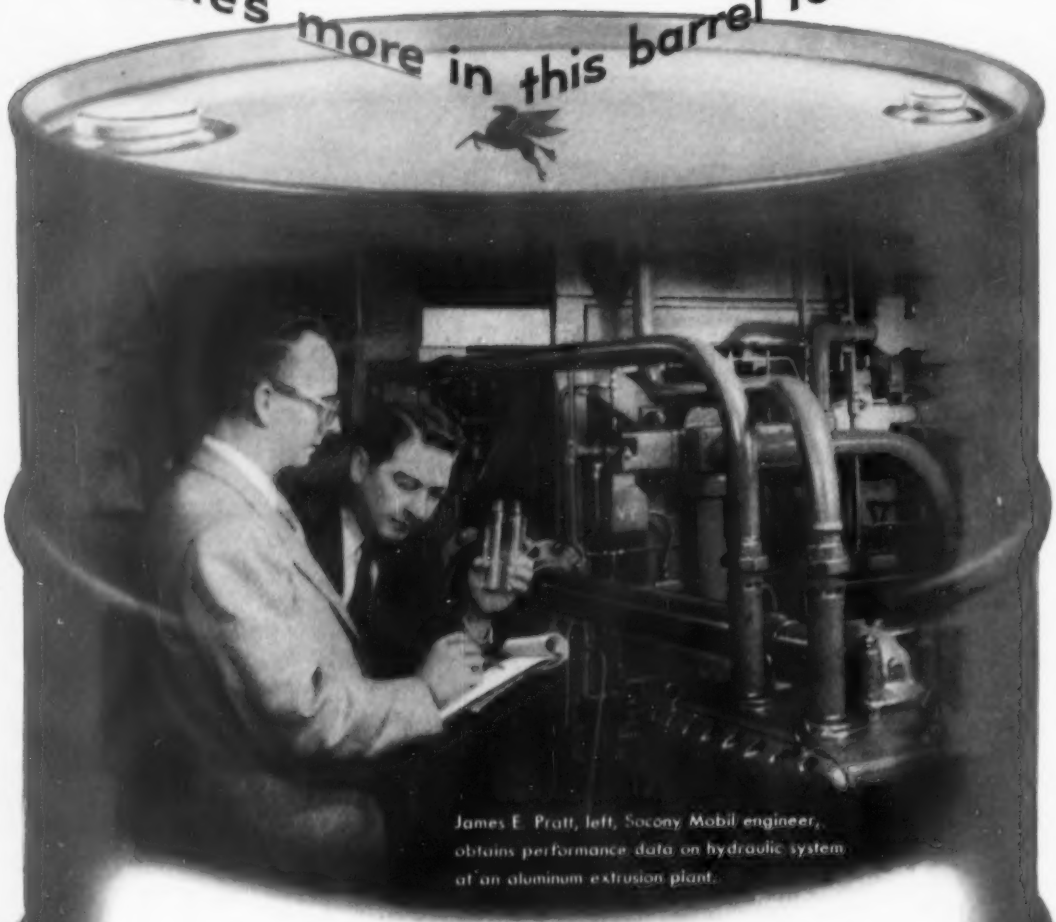
Company .....

Street .....

City ..... **State** .....

GENERAL ELECTRIC

There's more in this barrel for you...



James E. Pratt, left, Socony Mobil engineer, obtains performance data on hydraulic system at an aluminum extrusion plant.

MORE ENGINEERS
to help you improve production and cut costs!

Specify Socony Mobil and get the services of more industrial lubrication engineers than are provided by any other oil company.

These specialists, working closely with your Mobil representative, will help you set up a plant-wide program of correct lubrication . . . advise on any lubrication problems that might arise. Their long experience and expert recommendations can improve your production and cut costs.

Socony Mobil products are also backed by *more* services for analyzing petroleum products in use . . . *more* on-the-job training of your personnel in correct product application . . . *more* approvals from machine builders . . . *more* continuous research to assure continually improved products . . . *more* practical experience—90 years!

Always specify Socony Mobil. There's *more* in every barrel for you!

SPECIFY
SOCONY MOBIL

FIRST STEP
IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY
GENERAL PETROLEUM CORPORATION

LUBRICANTS • FUELS • CUTTING FLUIDS • WAXES • SOLVENTS • PLASTICIZERS • PETROCHEMICALS

New Plant Now In Full Production

Smooth operation in the new and larger Staples plant has stepped up production, also enlarged the stocks kept on hand. You can expect prompt shipments on craftsmen-produced Staples tools—and confidently expect them to keep your production costs at a minimum.

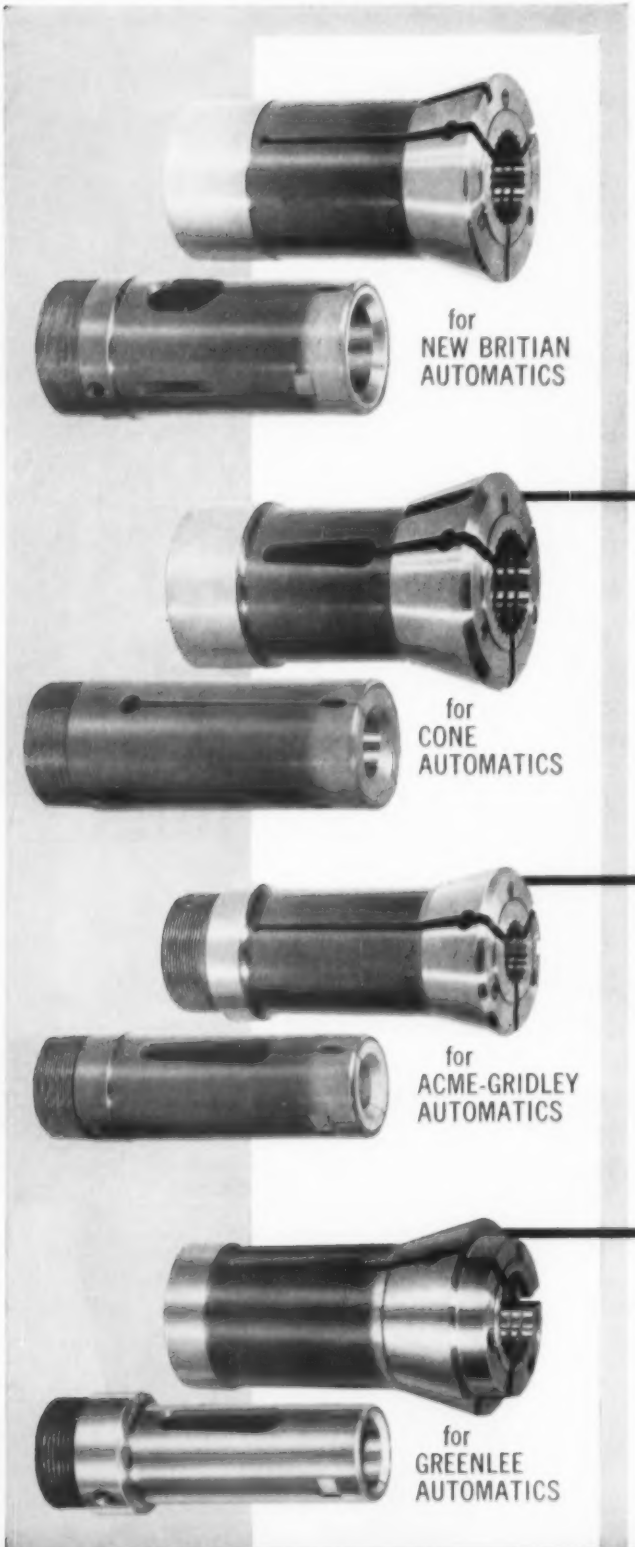
Staples carbide tipped tools include: expansion reamers, solid reamers, drills, end mills, counterbores, milling cutters.

THE Staples TOOL COMPANY

2352 Glendale—Milford Road, Evendale, Cincinnati 15, Ohio

Staples

ROTATING CUTTING TOOLS CARBIDE-TIPPED



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ELMIRA, N.Y.

MASTER COLLETS AND MASTER FEED FINGERS

for ECONOMY and PERFORMANCE

Hardinge Master Collets
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both with low-cost, interchangeable pads —
solve production and cost problems
for all automatics.

Hardinge Style "S" Master Collets
are the only masters
with no work pressure on the screw . . .

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save from 30% to 80%
over conventional solid feed fingers.

Also
Master Feed Fingers and Pads
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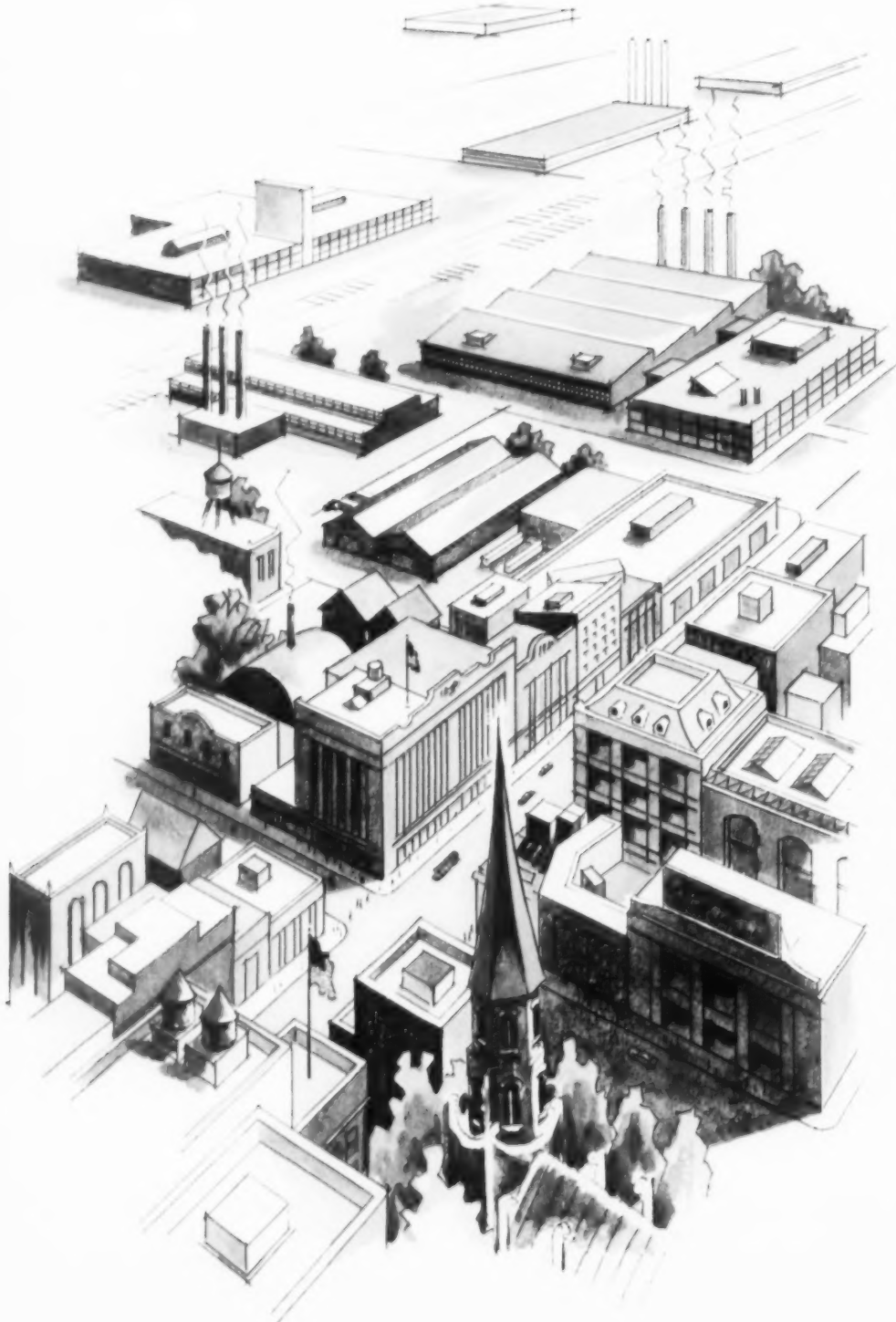
"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Immediate stock delivery from Elmira, Dayton, Chicago, Minneapolis, St. Louis, Detroit, San Francisco, Los Angeles, Philadelphia, Hartford, New York.

COME WITH US AND
MEET SOME OF THE
IMPORTANT MEMBERS OF
THE PUTNAM FAMILY

YOUR PUTNAM DISTRIBUTOR

Serves Local Industry



We, at Putnam To
distributor organiza
making for 20 ye
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men, respected me
make their business

Our distributors . . .
form an invaluable
economic system. Be
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Because of the natu
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labor experts, etc.

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In either case they a
taxes and services
munal wealth.

With their roots dee
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distributors are four
in church and scho
municipal governme
American . . . solid b

This is why we, at P
a privilege to be a
express our thanks

R . . .

try and the Community

m Tool Company, are proud of our ganization . . . which has been in the 20 years. Strategically located from , it consists of carefully chosen business ed members of their community who siness a career of service.

rs . . . and countless others like them . . . luable link in the chain of America's em. Because of them and their business we, as a manufacturer of end mills, out the country: warehouses, display al inventories from which our products nd quickly delivered to industry.

e nature of their business they must be ty . . . have wide knowledge of many n distributor personnel are familiar ols and their applications in manufac- ses. Into the bargain they must be okkeepers, market analysts, tax and etc.

d their places of business are an inte- heir communities. They are employers . sometimes large, sometimes small. hey are substantial business men whose ervices contribute materially to com-

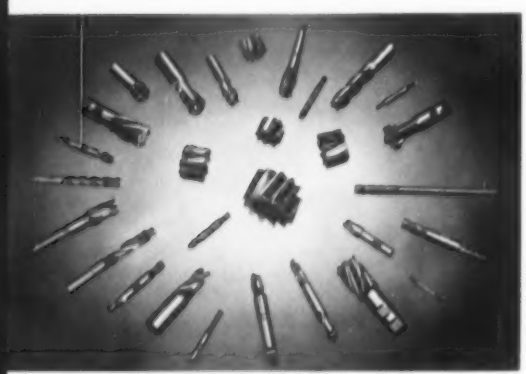
ts deep in their respective communities e an active part in civic affairs. Putnam e found on the rosters of service clubs, d school activities, and serving with ernments. They are in short: thoroughly solid business men . . . good neighbors.

, at Putnam Tool Company, consider it be associated with these men and to anks for the things they do.

PUTNAM
TOOL COMPANY
2981 CHARLEVOIX AVENUE • DETROIT 7, MICHIGAN

OVER 1400 STANDARD TYPES AND SIZES OF PUTNAM HI-SPEED END MILLS

For your convenience and quickest delivery, Putnam catalog lists over 1400 standard types and sizes of highest quality . . . faster cutting . . . longer lasting Hi-Speed end mills. These standard end mills are carried in stock at the factory and by Putnam distributors throughout the country. This means . . . there is a Putnam standard for nearly every milling operation . . . you can select a standard end mill from the catalog today and it can be on your job tomorrow . . . simply call your local Putnam distributor.



PUTNAM RIGID QUALITY CONTROL

Putnam end mills are made by specialists having years of valuable experience . . . machined from high speed steels of rigid analysis . . . produced under a close quality control system that includes individual inspection for a score of important details.

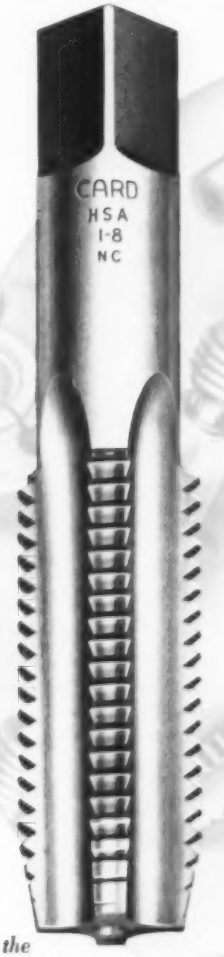
PUTNAM POSTIV-LOK END MILLS

- ★ *Eliminate Integral Shanks*
- ★ *Reduce Change-Over Time*
- ★ *Assure Positive Locking*

5073 LITHO IN U.S.A. 45M DO 356

PUTNAM TOOL COMPANY
2981 CHARLEVOIX AVENUE • DETROIT 7, MICHIGAN

TAPS *by* Card



Card taps, world-famous for over 80 years, are quality manufactured to meet your most exacting demands. Specify Taps, Gages and Dies By Card — for accuracy — low cost — top performance.

Presenting the Symbol of Service

YOUR CARD DISTRIBUTOR

The CARD Quality

GAGES *by* Card

S. W. CARD MANUFACTURING CO., Mansfield, Mass. • *Division of Union Twist Drill Company*

TAPS • DIES • SCREW PLATES • GAGES

it takes top cutter design to get best cutter performance!

BARBER-COLMAN offers

Special Form Development

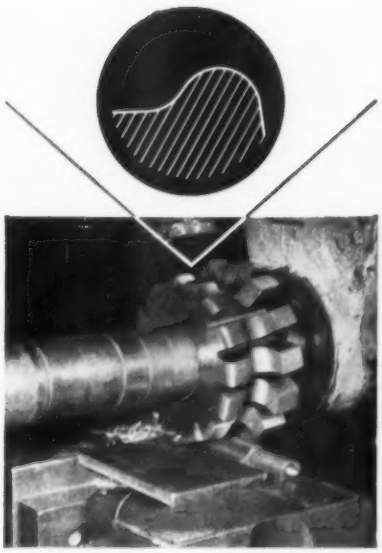
Special form-relieved cutters often allow several operations to be combined into one. Barber-Colman Engineers are experts in designing special tooth forms on form-relieved cutters for solving specific milling problems.

Our cutting tool division has the complete engineering, manufacturing and inspection facilities for making specially-designed form-relieved cutting tools of the finest quality. In addition to designing special forms, our engineers will design into the cutter such special features as axial side clearance, rake angles and helical flutes in any combination to produce maximum cutting efficiency. The best high-speed steel for the specific material to be cut is specified by our experienced engineering staff.

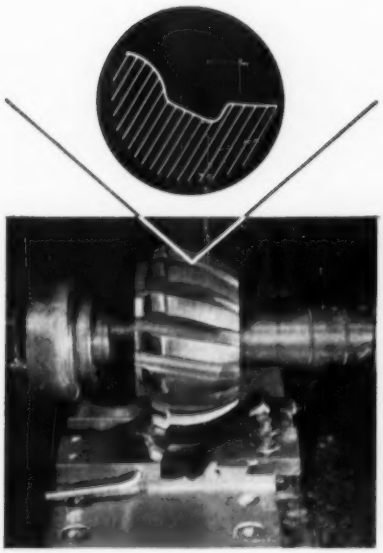
Barber-Colman form-relieved cutters require no "spot sharpening". Accurate face sharpening will maintain the correct form for the life of the cutter. This is true on all cutters including those with axial relief, rake or helical flutes.

Application of Axial Relief

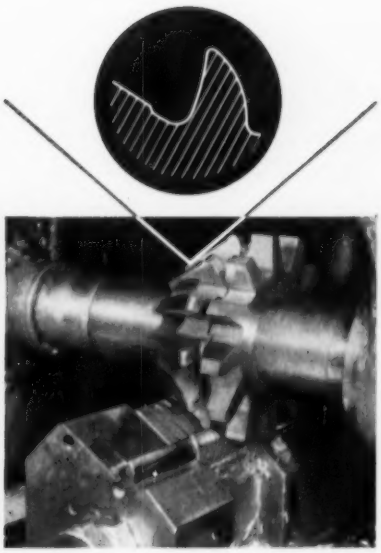
Surfaces which are in a plane perpendicular to the axis of the cutter, or nearly perpendicular, cannot be milled with a form-relieved cutter unless the cutter teeth are provided with axial side clearance. Barber-Colman can solve this problem by making the cutter with axial relief in one or both directions so that several cuts can be combined into a single milling operation. These applications show the proper use of axial clearance and helical flutes.



The form on this part has one side which is nearly perpendicular to the axis of the cutter, requiring a cutter with axial relief as well as radial relief. Both the axial and radial relief are formed onto the cutter tooth at the same time, and they are both applied to the complete tooth form. Consequently, the faces of the teeth can be sharpened without changing the tooth form. Helical flutes are provided to produce a shearing cut for improved finish and cutter life.



The form on this cutter is provided with both radial and axial relief because one small section of the form is nearly perpendicular to the cutter axis. Without axial relief, the perpendicular portion of the form would wear rapidly because of insufficient clearance. However, since the entire form has ample clearance behind the cutting edge, cutter life is greatly improved. Helical flutes eliminate any chatter during the cutting operation.



The workpiece in this application is tipped at an angle so that there is no undercut portion in relation to the axis of the cutter. However, in its cutting position, both sides of the form are nearly perpendicular to the cutter axis. The cutter is a two-piece interlocking type with axial relief in one direction on one side of the form, and in the other direction on the other side of the form. As the cutter is sharpened the form spreads apart, but the correct shape of the form is maintained. The proper dimensional relationship between the form is maintained by simply grinding the spacer between the two sections to the proper thickness.

These are only a few examples of the many special cutter problems passing through our Engineering Department daily. We welcome the opportunity to work with you in solving your production problems, and we invite you to send us part prints. Get top cutting efficiency through top cutter design.

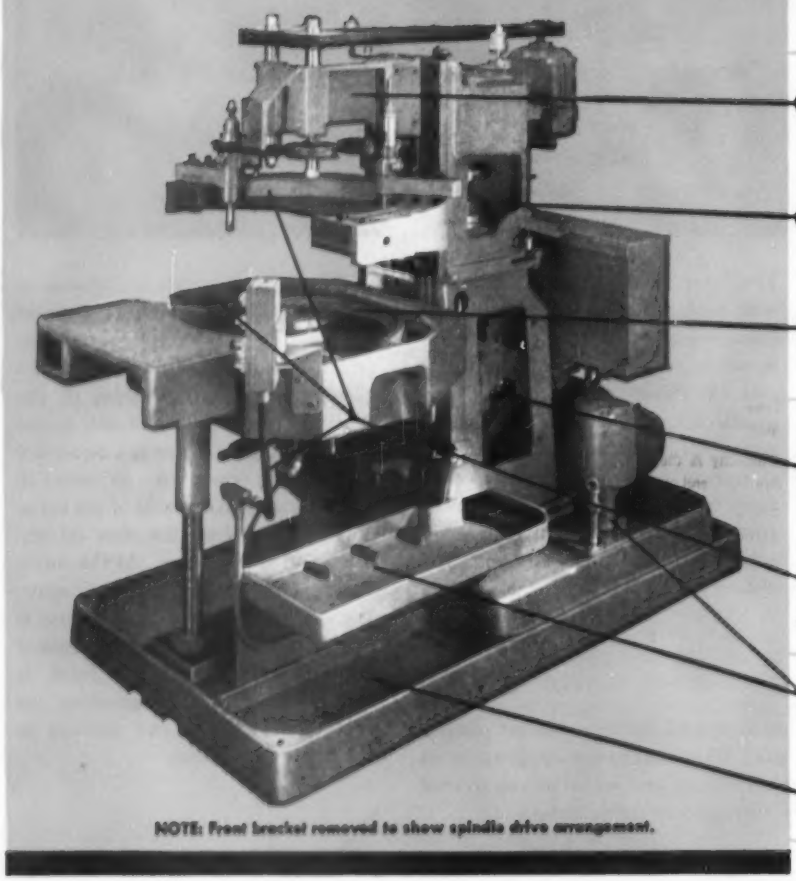
BARBER-COLMAN COMPANY

815 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

SAVE TIME AND MONEY
BY BUILDING YOUR "SPECIALS"
WITH Bodine



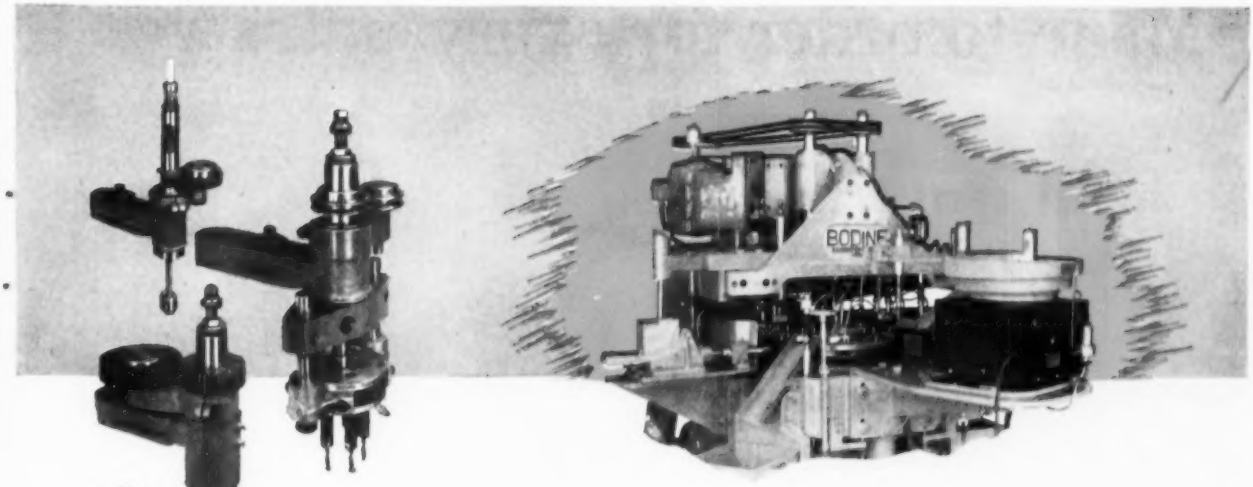
NOTE: Front bracket removed to show spindle drive arrangement.

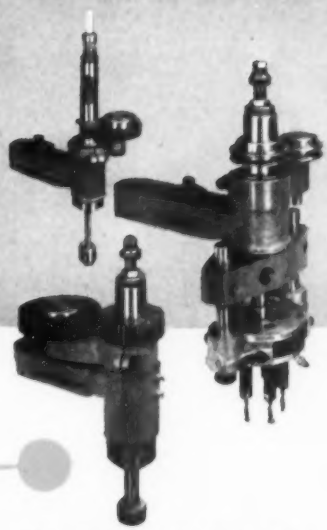
BASIC UNITS

- Central and flexible jack shaft drive to vertical spindles.
- Variable, quick-change, cam-controlled, synchronized vertical motion.
- 6 standard interchangeable table indexes, from 10 to 24 stations.
- All power drive through SINGLE main shaft for simple timing and adjustment.
- Ample mounting surfaces for tooling and attachments. Tool mounting areas are standard, making all tooling interchangeable.
- Central coolant system.
- 4 standard Basic Machine sizes.

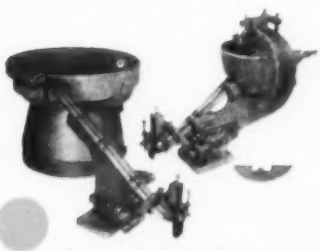
Few pieces of production equipment available today can match the practically unlimited versatility of this Bodine Basic Machine or the features it offers at such remarkably low cost. Equally important . . . while every day sees NEW developments in tooling and application, the BODINE MACHINE and standard tooling equipment remain as well-proved BASIC designs from which the "bugs" have long since been eliminated.

Bodine BASIC Machines are made in four sizes capable of high volume production of a wide range of small interchangeable parts, especially where multiple operations are required. The Basic Machines and spindle units may be purchased separately or in any combination by those who wish partially or wholly to design and build their own specials.

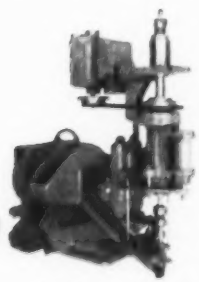




Wide range of standard spindles for drilling, reaming, tapping, threading, milling, screw-driving, etc.



Service-proved standardized automatic feed methods and units.



Screw-inserting mechanisms available as complete units.

Standardized spindles for horizontal, inverted or angular mounting.

YOUR STANDARDIZED, FLEXIBLE ANSWER TO...

HIGH PRODUCTION NEEDS

MULTIPLE TOOLING PROBLEMS

RAPID CHANGE-OVER

Time and again we hear the statement, "If we had known what can be done with a Bodine Basic Machine, we would have saved ourselves a lot of headaches in building our own specials."

Simplicity is the keynote of Bodine Basic design . . . simplicity combined with positive precision operation and control to assure accurate repetition of production cycles.

A single main drive camshaft times and controls all indexing and tool feed motions with full provision for simple, precise mechanical adjustment. This permits extremely accurate timing of all operations in the cycle with positive mechanical interlock. It also makes for ideal accessibility for changing of cams, aiding in rapid change-over.

Another important Bodine feature is the very broad range of standard spindle types and sizes available, which can be modified if necessary to meet essentially any practical need. Drill spindles are available in four standard sizes and are easily adjustable for a wide range of speeds. They carry a micrometer adjustment for extremely fine setting. Bodine specially designed tapping spindles can consistently maintain Class 2 (plus) fits. Lead screw units are available for Class 3 fits. Horizontal, angular and inverted spindles are fitted to many machines.

Furthermore, you no longer need to consider the investment in a "single-purpose" machine at production termination. Investigate these unusually successful Bodine Basic Machines and methods. In nine cases out of ten, we can give you a PRE-TESTED answer to your problem at far less cost. Write outlining your needs . . . or send us prints and samples for analysis.

THE

Bodine

CORPORATION

BRIDGEPORT 5, CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

Made to order for every industry!

THOR AIR IMPACT WRENCHES

THOR Reversible Air Impact Wrenches save a lot of time and money on every operation involving nut running, screwdriving, reaming, tapping, applying and removing studs. Thor Wrenches work faster, with less stress on working parts, because they spin nuts down tighter before impacting. Thor reversible power removes "frozen" nuts, bolts, and screws in seconds. And because there is no torque reaction, Thor Air Impact Wrenches are completely safe.

Low maintenance is assured because Thor ball-bearing motors are fitted into wrenches as self-contained units. Oversize spring never wears out. Finest tool-steel gears are precision cut and heat-treated for endless wear. Thor's line of accessories meets every need. Ask your nearest Thor factory branch for demonstration. Thor Power Tool Co., Aurora, Ill.

COMPLETE RANGE OF SIZES

Thor Air Impact Wrenches are available in all six of the most-wanted sizes: Bolt size capacities include ¼", ⅜", ½", ¾", heavy duty ¾", and 1¼".

Thor PORTABLE POWER TOOLS

Atlanta • Birmingham
Boston • Buffalo
Chicago • Cincinnati
Cleveland • Denver
Detroit • Houston
Los Angeles • Milwaukee
Newark • Long Island City, N.Y. • Philadelphia
Pittsburgh • St. Louis
San Francisco • Seattle
Toronto, Canada • Export Division, New York City

THOR POWER TOOL COMPANY

Stainless Steel
machining information:

drilling is easy—if you're careful

When you drill chromium-nickel (austenitic) Stainless Steels, use the shallowest punch mark possible. If you punch too deep, there will be a hard spot, and you'll have trouble starting the drill. Most fabricators use a triangular or square-pointed punch for this reason.

High speed, short-twist drills should be used. They should be ground slightly flatter than usual, and with a greater back clearance than you would use for carbon steel. High speed drills are recommended, although for very smooth holes you might try carbon steel drills because you can often put a sharper edge on them.

Be sure that you use enough power and pressure to get a continuous cut; otherwise the drill will ride in the bottom of the hole and work-harden the steel. A backing plate should always be used, because austenitic Stainless Steels will not break out ahead of the drill.

Try step drilling for very deep holes. Keep the drill cool, and always use a cutting compound such as the lard oil-sulfur mixture described on page 58 of our Stainless Steel "Fabrication" book. Don't you have a copy of the book? Just write on your company letterhead to United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

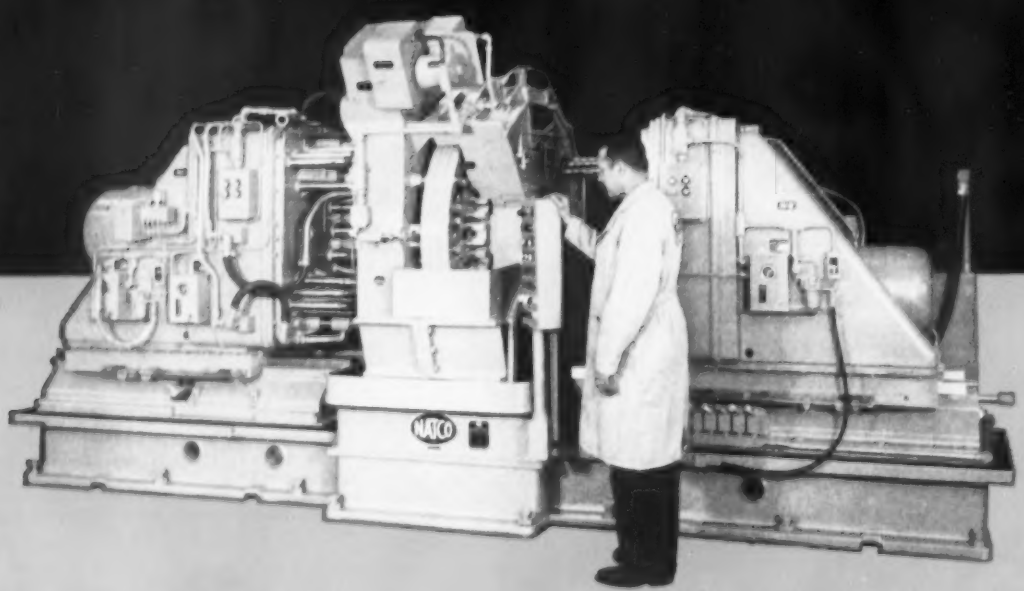
USS

USS STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS
PIPE · TUBES · WIRE · SPECIAL SECTIONS

UNITED STATES STEEL

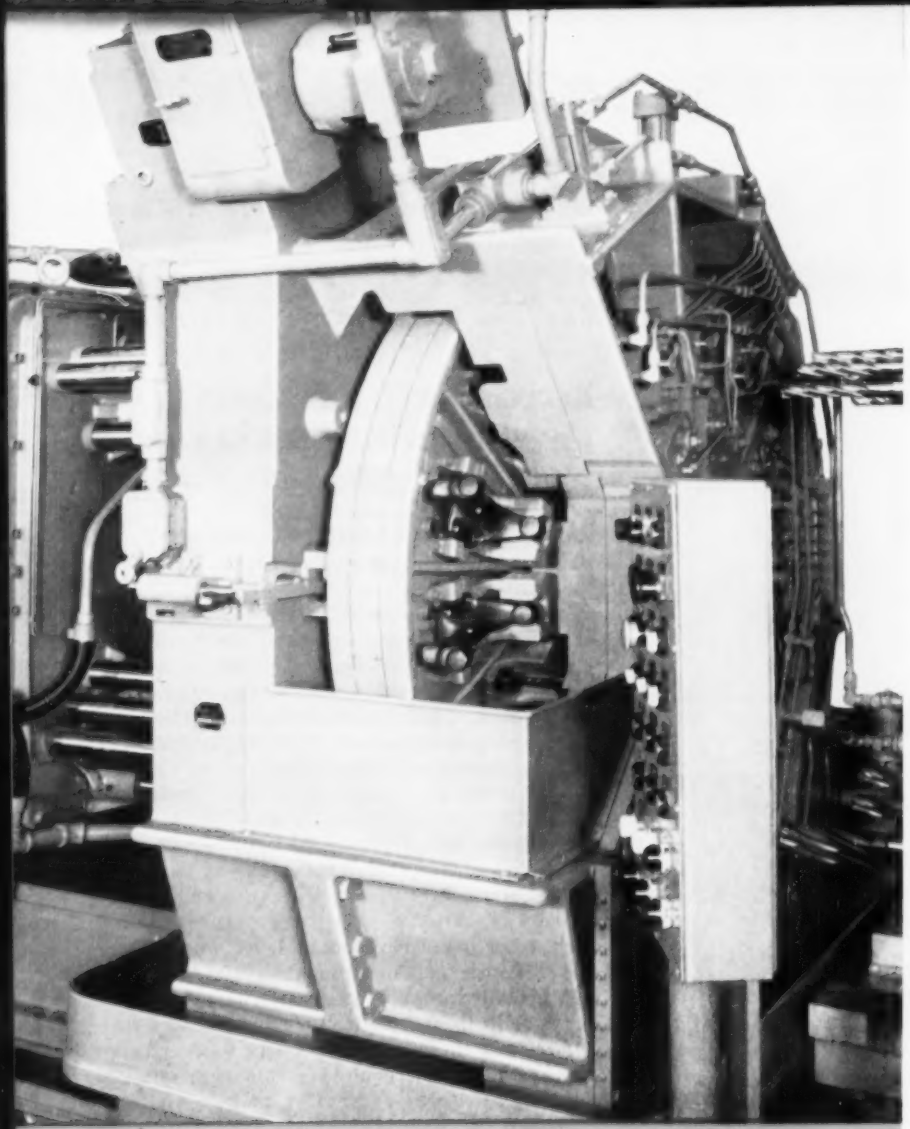
New Natco® Performs 17 Operations Every 15 Seconds



Performance—this Natco 2-way horizontal drilling machine produces 250 steering knuckles per hour. Holds limits as close as .004". Parts are clamped automatically in the interlocked trunnion fixture—spot-drilled, drilled, spotfaced, reamed and counterbored.

Features—Automatic time delay reverse, positive stop, coolant system with magnetic chip separator, automatic lubrication to heads and ways, hydraulic feed and J. I. C. compliance. Let a Natco field engineer help you with your drilling, boring, facing and tapping problems.

Ask for information about the PAYD (Pay-As-You-Depreciate) finance plan.



Notes from Natco...

Whole Hog or Piecemeal

Seems like two distinct approaches are being taken in the adoption of automatic assembly methods. The "whole hog" school favors abrupt change . . . wait until you can install a machine that will handle the *complete* assembly job. The "piecemeal" school favors a step-by-step transition, starting with the basic transfer mechanism and adding automatic stations one or two at a time.

Variety Show

The critics say you can't have high production and versatility, too. But one of our eastern customers has run his drilling show that way for years. On seven adjustable multi-spindle Natcos, he drills and taps over 1000 different parts in lots from 50 to 10,000.

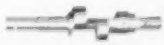
Shuttle for Speed

Like the Three Musketeers, drilling, chamfering and tapping go together. Natco is now building sliding tables for their small standard machines allowing all three operations with one push of the button. Starting in drilling position, table automatically indexes for chamfering and tapping; then returns. Up to 24 operations at a crack.

Processed by Natco Machines

Part: Gear Housing
Machine: Natco vertical Holesteel
Operations: Drill 11 holes; Counterbore 1 hole; Chamfer 3 holes; End cut ream 1 hole; Combination ream, face and chamfer 1 hole; Ream 3 holes.
Production: 90 per hour

Part: Cylinder Block
Machine: Natco Holesteel
Operations: Drill 17 holes in 4-cylinder block or 23 holes in 6-cylinder block.
Production: 40 parts per hour



Part: Shaft
Machine: Natco H-5
Operations: Combination drill and chamfer 3 holes; Drill 4 holes.
Production: 80 parts per hour

NATIONAL AUTOMATIC TOOL COMPANY, INC.
Richmond, Indiana

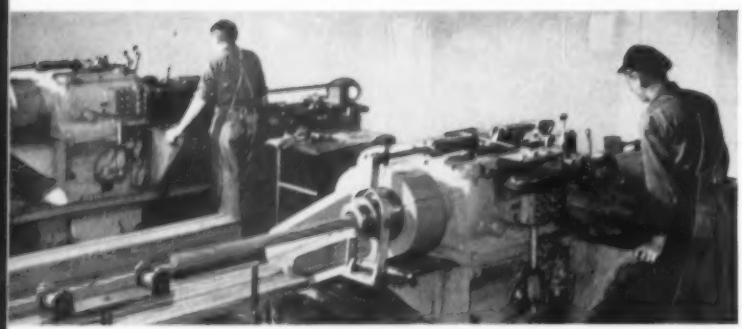
Multiple-spindle drilling, boring, facing and tapping machines
Special machines for automatic production

NATCO

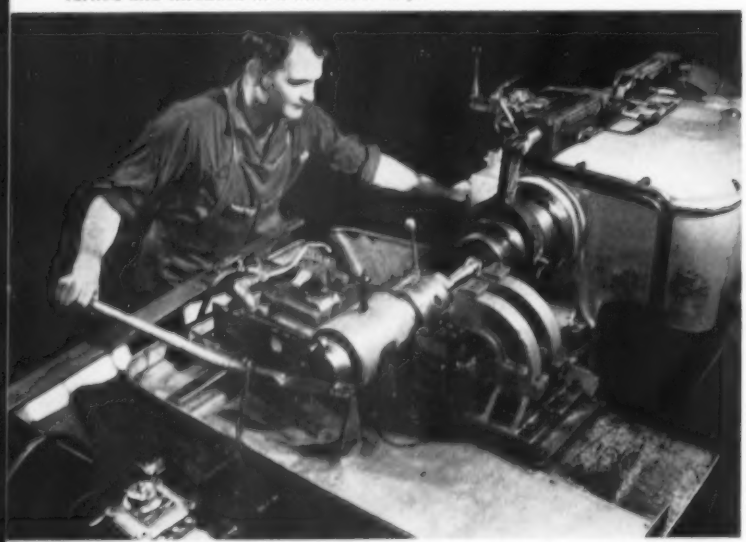
Call Natco offices in Chicago, Detroit, Buffalo, New York, Boston, Philadelphia, Cleveland and Los Angeles; distributors in other cities.

AXELSON production

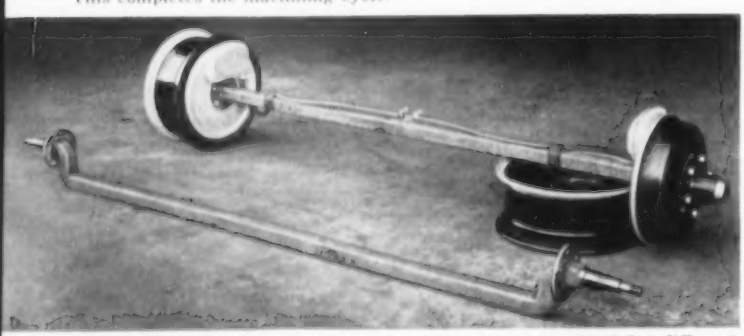
AXELSON MANUFACTURING COMPANY



AUTOMATIC CYCLING. Using two Axelson 20" heavy-duty lathes, equipped for automatic cycling and speed changing, 200 or more axles can be contour-turned and threaded in a nine-hour day.



THREADING. After finish-turning bearing surface, spindle speed is automatically reduced from 1150 to 175 r.p.m. for threading with high-speed steel dies. This completes the machining cycle.



PRODUCTION PARTS. Axelson lathes are used to turn the ends of five different size axles at Hadco. The ones shown above, with and without brake drums, are 1½-inch square SAE steel bar stock.

AUTOMATIC CYCLING LATHES DOUBLE AXLE PRODUCTION...

improve accuracy... lower maintenance costs

Axelson heavy-duty 20" lathes equipped with electronic controls and hydraulic power units for automatic cycling and speed changing have made it possible for Hadco Engineering Company, Huntington Park, California, to double production and improve accuracy as much as 300 to 400% in turning the ends of trailer axles.

Two lathes can contour-turn and thread both ends of 200 or more axles in a nine-hour day. The only manual operations are loading and unloading the lathes and advancing the threading tools. Hydraulically operated collets on both ends of the spindle grip the 1½" to 2½" square or round SAE 1045 bar stock when a single lever on the headstock is operated. The automatic cycle of the lathe is started by pressing a button, which causes the cross-slide to automatically move forward to a stop. Then the carriage advances to rough-contour-turn all the required surfaces on one end of the axle.

When the carriage returns, the cross-slide shifts automatically until it comes in contact with a second stop, which aligns the box-type turning tools with the work. The carriage then advances to finish-turn the straight bearing surface to the required size. After the carriage returns, the spindle speed is automatically reduced from 1150 to 175 r.p.m. for threading, the cross-slide moves to a central position, and the threading die head is advanced manually. At the completion of the threading operation the operator breaks the sharp corners on the work piece with a hand file and stops the machine, completing the cycle. Actual machining time for each axle end is 1½ minutes.

Grade 370 Carboloy is used for the contour and box-type turning tools, while the threading dies are of high-speed steel. Both rough and finish turning operations are performed at a feed of 0.015 inch per revolution.

Within a year after the Axelson lathes were installed it was found that maintenance costs had dropped sharply. Furthermore, the chatter, breakdowns, whipping and bending that had resulted from turning odd-shaped pieces at high speed on other lathes, were eliminated.

and maintenance news

DIVISION OF U. S. INDUSTRIES, INC. / 6160 SOUTH BOYLE AVENUE, LOS ANGELES 58, CALIFORNIA

New 32" heavy-duty lathe has 75-hp headstock... handles peak loads to 100 hp.

Axelson's new 32" heavy-duty lathe is a rugged tool that can be used with equal effectiveness on rough or precision cuts. It has 24 spindle speeds in true geometric progression from 6 to 750 r.p.m.

The main bed casting is designed for maximum stability and for resistance to the twisting forces of heavy-duty turning. The carriage bed ways are hardened and ground alloy steel.

Two levers control the selection of feed changes on the new Axelson totally enclosed gear box. There are 81 feeds, ranging from .005" to .351" per revolution of the spindle; 45 threads may be cut, ranging from 1 to 30 threads per inch. This range of feeds and leads is sufficient for the large majority of all machining operations.

The extra-heavy, box-type apron is completely enclosed, which permits all shafts and gears to run in a continuous oil bath. All carriage controls are located on the apron convenient to the operator. Clutch levers operate cross and longitudinal feed controls.

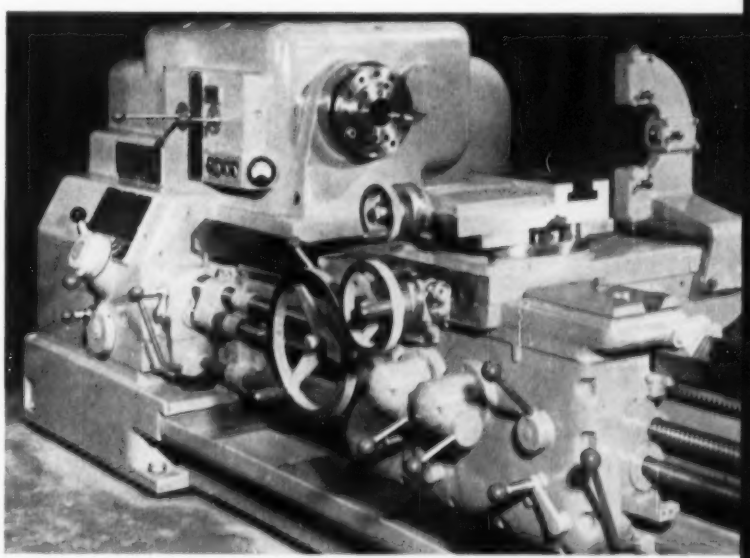
The tailstock is a rugged one-piece casting. The two-speed feature provides rapid movement of the tailstock center up to the work piece, and slow powerful movement of the spindle for feeding drills, reamers, or other tools held in center. The tailstock can be easily moved manually in either direction by a hand crank at the front of the machine.

A micrometer cross-feed positive stop, which permits the operator to set the cross-slide travel to stop at a predetermined point, is positive, will not slip, and will permit accurate dimensions to be duplicated repeatedly.

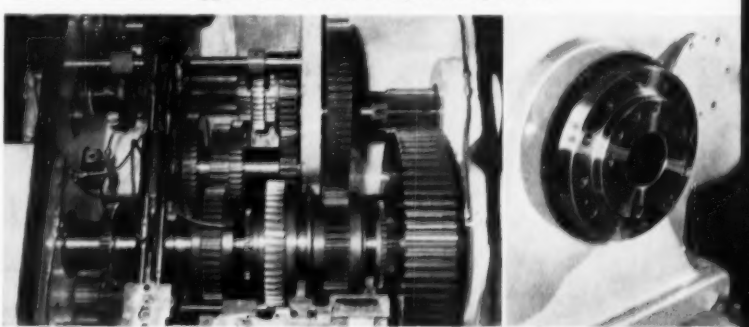
Standard equipment is the power rapid traverse for quickly moving the carriage in either direction. This feature saves valuable production time and reduces operator fatigue to a minimum. A lever mounted at the left-hand side of the carriage controls the carriage movement.

For a complete description and detailed specifications on Axelson Tool Room, Medium-Duty and the new 25/16 and 32" Heavy-Duty Lathes: Write for bulletins A5-5507 and 5504.

AXELSON **Manufacturing Company**
Division of U. S. Industries, Inc.



NEW 32" HEAVY-DUTY LATHE. Designed for flexible, effective operations, this machine combines rugged construction and precise operation.



HEADSTOCK. Twenty-four spindle speeds divided into a true geometric progression from 6 to 750 r.p.m. are ideally suited for a wide variety of work, permitting high speed turning and large diameter work in new metals and alloys.

SPEED SELECTION. Two levers make speed selection simple and fast. Position of the levers tells operator the speed at which spindle is running or the speed change desired. Automatic electric brake stops spindle instantly.

Something more

than pushbuttons...

starts the machine-built accuracies in a *Hendey* Tool and Gage-Makers' Lathe

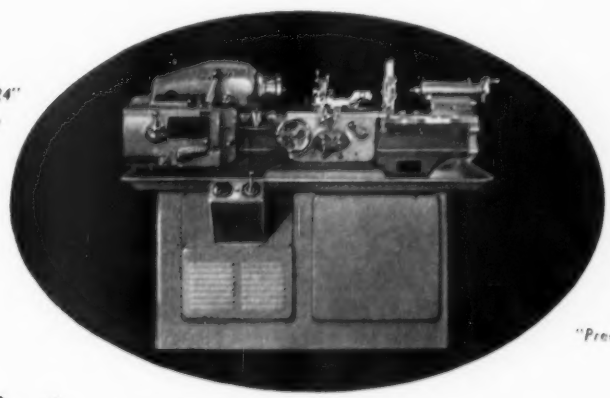
Precision *begins* with precision!

At the left a Hendey worker checks headstock spindle bore alignment of a 9 in. Tool and Gage-Makers' Lathe. *But,* before he pushes the "Start" button of his machine, he uses most exacting precision to lay out holes to be bored in the headstock. He begins by carefully locating the spindle bore, using "Jo" blocks (capable of measuring in millionths) to assure maximum accuracy. After finding this starting point, he locates other holes in precise relationship to it. Precision machining and finishing are the inevitable result of meticulous preparation and layout.

The 9 in. Tool and Gage-Makers' Lathe can be purchased with *electronically controlled* drive to provide quiet, infinitely variable spindle speeds from 15 to 3000 rpm. On facing cuts, stepped diameters, and tapers, operator can change speeds during the cut by selecting correct rpm on the control rheostat. Belt drive gives smooth, vibration-free power to the spindle for extra-fine finishes in the range from 25 to 3000 rpm. Speed range from 15 to 250 rpm is through back gears with very low velocity.

Remember, in your toolroom too — precision *begins* with precision! You can assure accuracy and reduce turning costs by installing a Hendey Tool and Gage-Makers' Lathe. Call your Hendey dealer now for complete information.

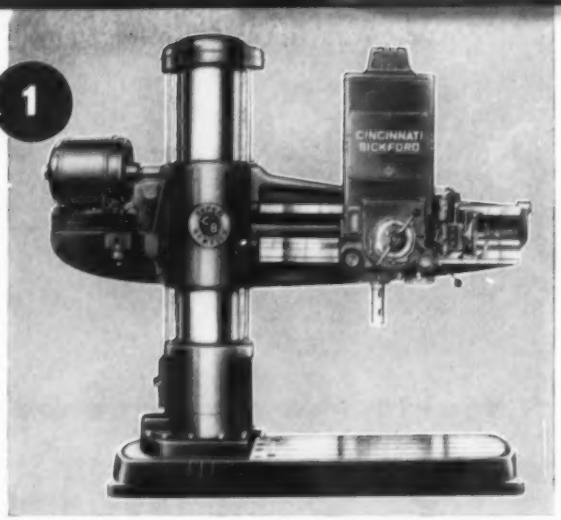
Hendey 9" x 24" Tool and Gage-Makers' Lathe



"Precision with Production"

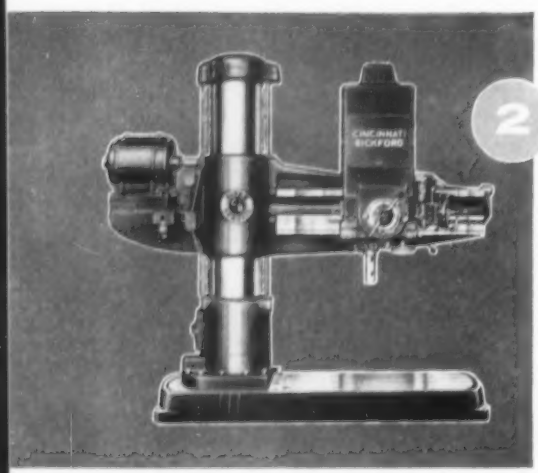
Hendey machine division
BARBER-COLMAN COMPANY
51 LOOMIS ST., ROCKFORD, ILLINOIS

BARBER COLMAN



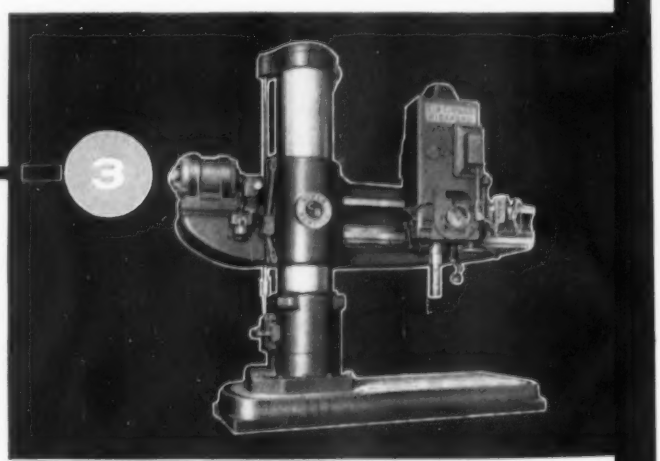
1

New 100% hydraulic pre-selection of all 36 speeds and 18 feeds gives this line of Super-Service Radials maximum performance and ease of handling. A simple prescheduling device shows speeds and feeds to be used on each successive operation and provides a permanent record. Ask for Bulletin R-33.



2

Speed range pre-selector, in conjunction with one speed change lever controls selection of 36 speeds. This new line of Super-Service Radials is for heavy duty work where split-second savings are not so important. Bulletin R-32 gives details.



3

Super-Service Radials with lever shifts for all speed and feed changes are still preferred by many who know the dependable ruggedness of these machines. Write for Booklet R-29.

One of these 3 will do your job BEST---

You have a choice, in Super-Service Radials, as to the extent to which automatic gear shifting and preselection of speeds and feeds will be employed. The highest development is shown at Fig. 1; but for many kinds of heavy duty work, the machine with speed range pre-selector and lever shifts for other changes, is to be preferred. Look at all three—by writing now for latest catalogs.

CINCINNATI BICKFORD

C·B SUPER SERVICE

RADIAL AND UPRIGHT DRILLING MACHINES

CINCINNATI BICKFORD DIVISION

GIDDINGS & LEWIS MACHINE TOOL COMPANY

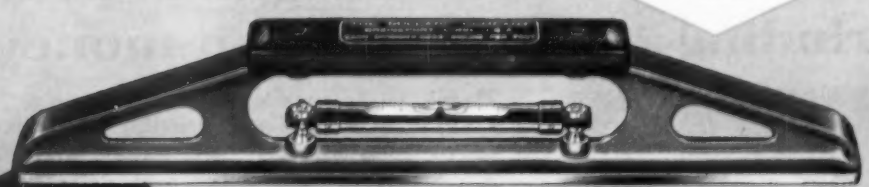
OAKLEY, CINCINNATI 9, OHIO, U.S.A.

when PRECISION COUNTS

You Can Count on a BULLARD Precision Aligning Level

Today's high standards of machining accuracy make it imperative that the machine is maintained level at all times. Among the innumerable factors that work against this condition are constant vibration, settling of buildings and floors and the molecular changes of cast iron and steel. Increase the life of machines — lower maintenance cost — by using a Bullard Precision Aligning Level.

AVAILABLE IN 12", 18" AND 27" SIZES



Check these Features

1. The vial used is made of the best optical glass, specially ground, and is filled and guaranteed by one of the greatest Level Makers in the world.
2. The vial is mounted on two brass studs, which permit adjustments in the same manner as the Level Vials on the finest surveying instruments.
3. The Bubble in the Vial has a guaranteed sensitiveness of 5 seconds of arc per graduation. This is equivalent to showing per graduation on Vial a variation of .0003 of an inch per foot.
4. The Level Casting is thoroughly insulated from the palm of the hand by means of a handle of special non-conductive material.
5. The design is the result of long experience. The casting has been seasoned, machined and scraped with meticulous care.
6. This Precision instrument is safely protected in a felt lined box.

THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT

MAIL THIS COUPON TODAY—

The Bullard Company
Bridgeport 2, Connecticut

Please furnish me prices on Bullard Precision Aligning Levels . . .

CHECK HERE: 12"_____ 18"_____ 27"_____

NAME _____

TITLE _____ CO. _____

ST. ADDRESS _____

CITY _____ ZONE _____

STATE _____

Got time to let us engineer your grinding job and save you money?

There's never been a better time to ask for a Peninsular study of your grinding problems. Our Abrasive Engineers are now backed by new, enlarged research and engineering facilities, and stand ready to serve you.

Tool grinding may be costing you plenty. Let Peninsular investigate, make recommendations if necessary. It may mean substantial savings to you, in the form of increased production or greater wheel life, or both.

Call, write, or wire us today!

Vitrified and Resinoid Grinding Wheels

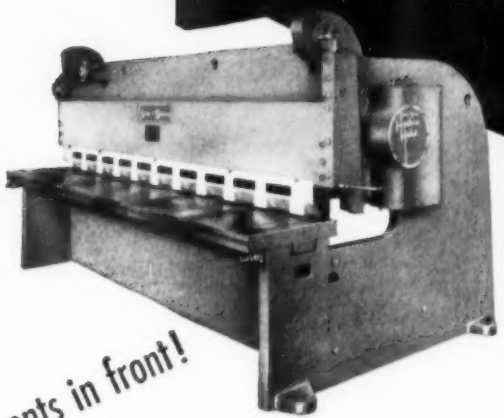
PENINSULAR

GRINDING WHEELS

PENINSULAR GRINDING WHEEL DIVISION – ABRASIVE AND METAL PRODUCTS COMPANY – DETROIT, MICHIGAN

Productioneered

by Lodge & Shipley



...all adjustments in front!

...all clear in the back!

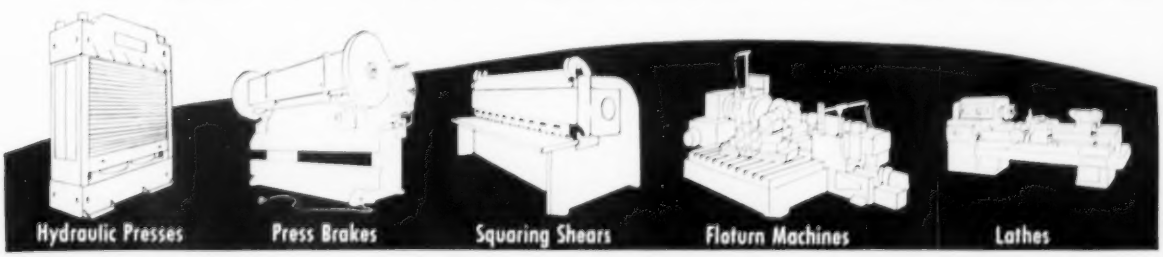
If you want a new standard of shearing performance . . . and lower costs too . . . investigate the proven features of the new Lodge & Shipley Squaring Shears. Engineered to production standards, these new shears represent more than 75 years of experience in development and refinement of metalworking equipment.

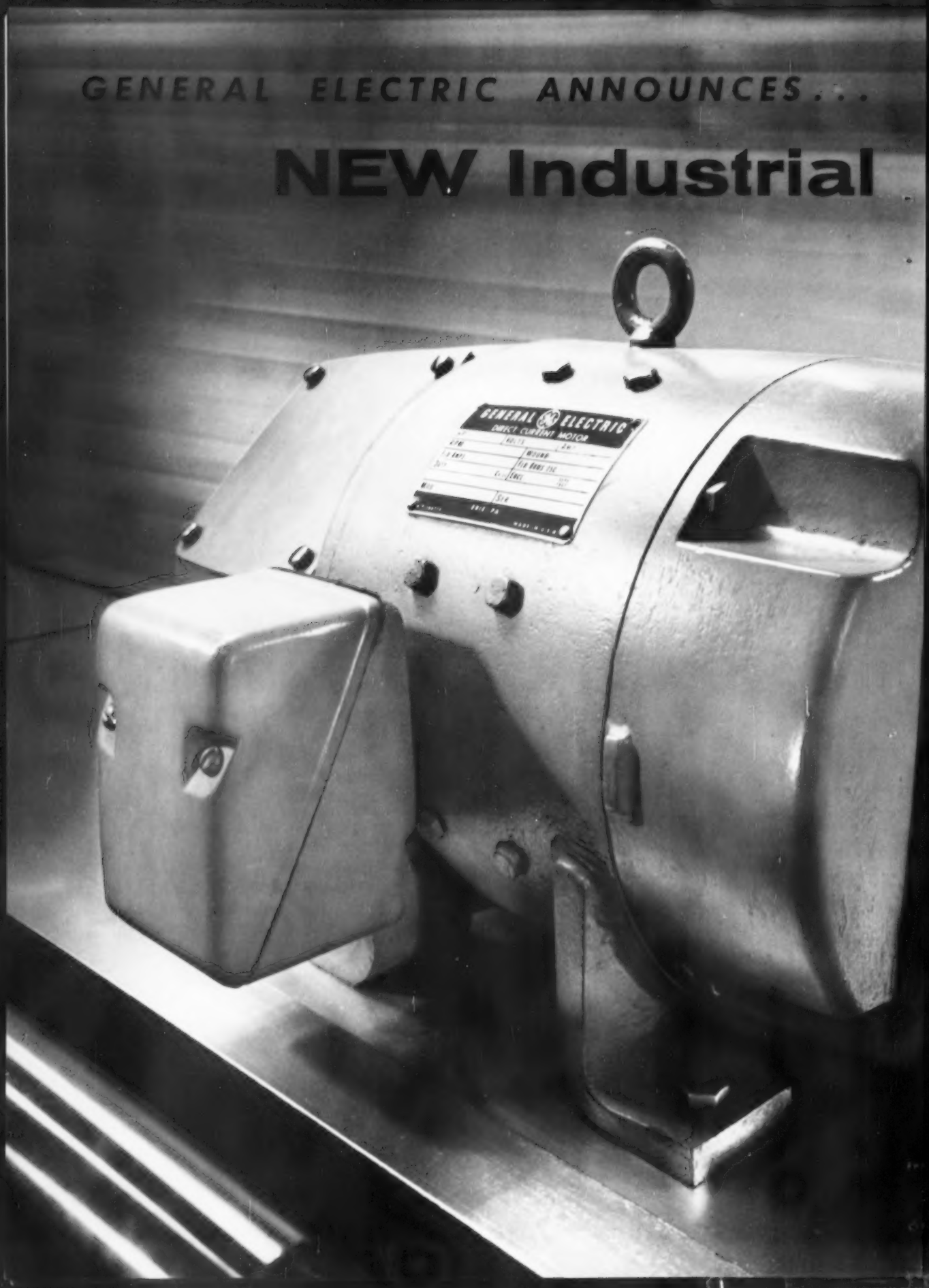
Many of the new and exclusive features combine to keep the operator in front of the machine and on top of his job. "Out front" adjustments and "all clear" design in back of the shear means that production can flow steadily at lowest cost!

New literature details the ease of operation, effortless accuracy and notable economy of Lodge & Shipley Shears. Write for your copy of Bulletin PS-9.

The Lodge & Shipley Co., 3056 Colerain Ave., Cincinnati 25, Ohio.

Outstanding Lodge & Shipley Features . . . Combination Air Clutch and Brake ● Long Life Gear Train ● Inclined Ram ● Air Ram Counterbalances ● Positive Lubrication ● Front Operated Back Gauge ● Positive, Safe Holddowns ● Forged One-Piece Eccentric Shafts ● Front Adjusted Ram Back Brace ● Front Adjusted Blade Clearance and Indicator




GENERAL ELECTRIC ANNOUNCES...
NEW Industrial
GENERAL ELECTRIC
DIRECT CURRENT MOTOR

Direct-current Motor

KINAMATIC* a new standard in direct-current motors, gives your machines wider speed ranges, greater output

To meet modern industrial needs for faster, more automatic, more continuous production, General Electric has designed an entirely new direct-current motor—the d-c Kinamatic.

Designed for Automation Now, a direct-current motor has been designed for the modern job it has to do—either as individual motor drive or in regulating systems. The new General Electric d-c Kinamatic motor supplies the wide speed range and versatility required for today's manufacturing methods. It is designed for the close control of machines and split-second timing of processes essential to higher output.

Accelerated Production The new d-c Kinamatic motor will modernize your equipment, give it increased power, higher speeds, greater output capacity. With the quick-acting G-E Kinamatic motor, your machines will process a greater variety of products . . . faster . . . easier . . . and with less maintenance and spoilage.

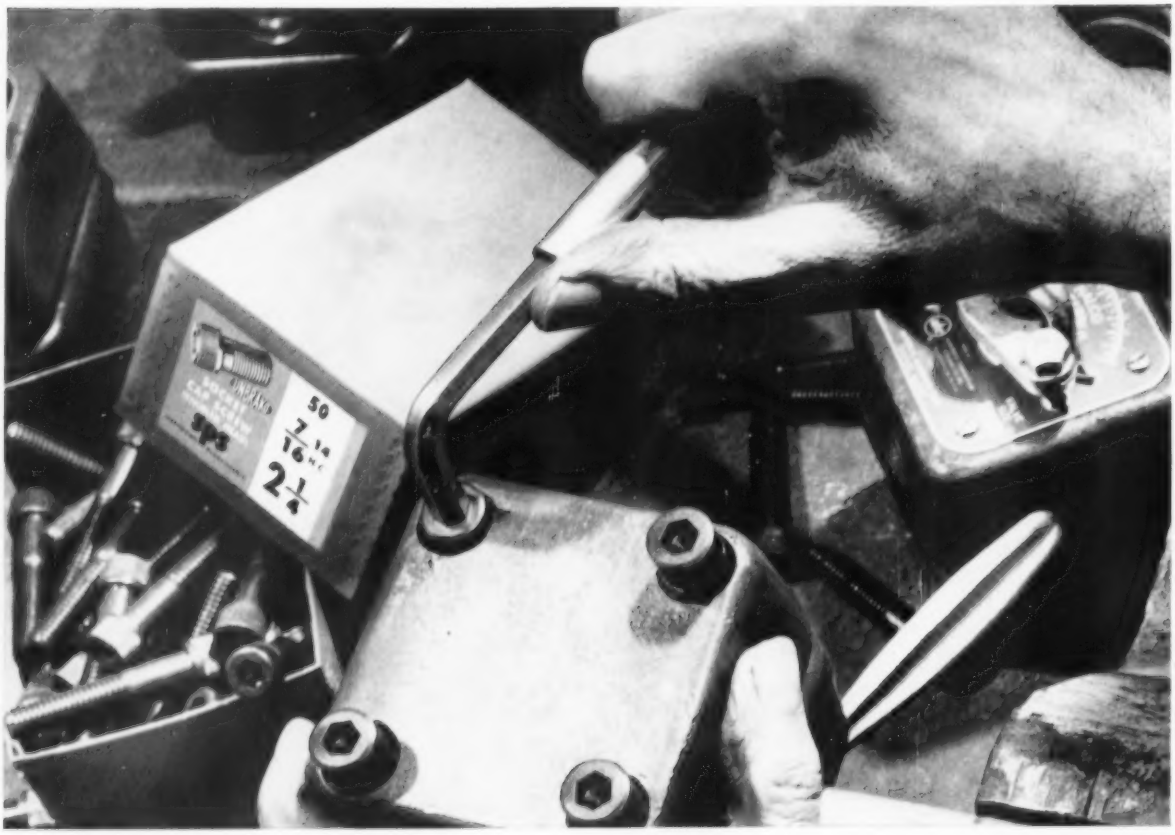
More Powerful By combining advanced design with improved materials and manufacturing techniques, General Electric engineers have packed more power into the entire Kinamatic line. The powerful Kinamatic motor, with new stamina and durability, is ready to become one of your most effective weapons for keeping costs down, for meeting competition, for boosting productivity levels.

Engineering Help Industrial specialists in 149 conveniently located General Electric Apparatus Sales Offices have the complete story on how the new d-c Kinamatic motors and generators can benefit your operation. For full details, contact your G-E Sales Representative, or write for Bulletin GEA-6355. *Direct Current Motor and Generator Department, General Electric Company, Erie, Pennsylvania.* 831

* Trade Mark of the General Electric Company

Progress Is Our Most Important Product

GENERAL ELECTRIC

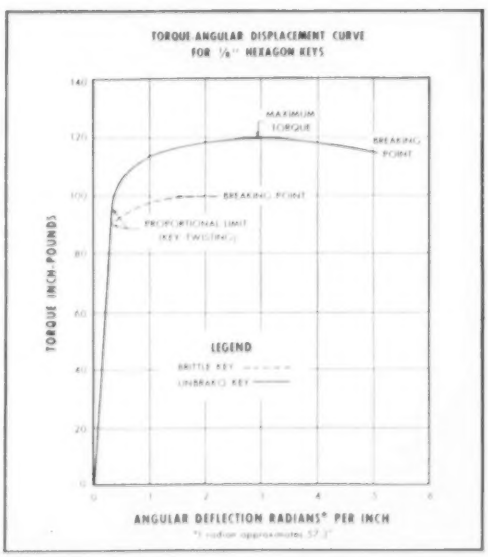


Tighten socket screws tighter, more safely with High-Titan UNBRAKO hex keys

High-Titan UNBRAKO socket screw keys are stronger than ordinary keys. They are made of selected, accurately sized hex stock, with carefully formed 90° bends that won't break. The ends are cut square to engage sockets full depth for highest tightening power. These keys are heat treated uniformly to give hardness and ductility clear through without brittleness or decarburization.

All this results in many advantages. You can torque up a screw tighter with an UNBRAKO than any other key. Performance is consistent—you can apply the same tightening torque every time. Screw sockets won't ream, and the keys won't wear excessively. If you should apply too much torque, a High-Titan would break, but shear off clean and even with the top of the socket—not at the bend—and without leaving jagged exposed edges to gash your hands.

One High-Titan hex key is included with each standard package of UNBRAKO socket screws. High-Titans are also available as sets in convenient, durable plastic key folds, and in bulk. Your authorized industrial distributor carries them in stock. See him today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 1, Pa.



THESE CURVES SHOW THE DIFFERENCE between an UNBRAKO hex key and an ordinary key. The UNBRAKO withstands more tightening torque, twists through 180° without breaking, then shears off even with the top of the screw socket. Ordinary keys snap off suddenly at the bend.

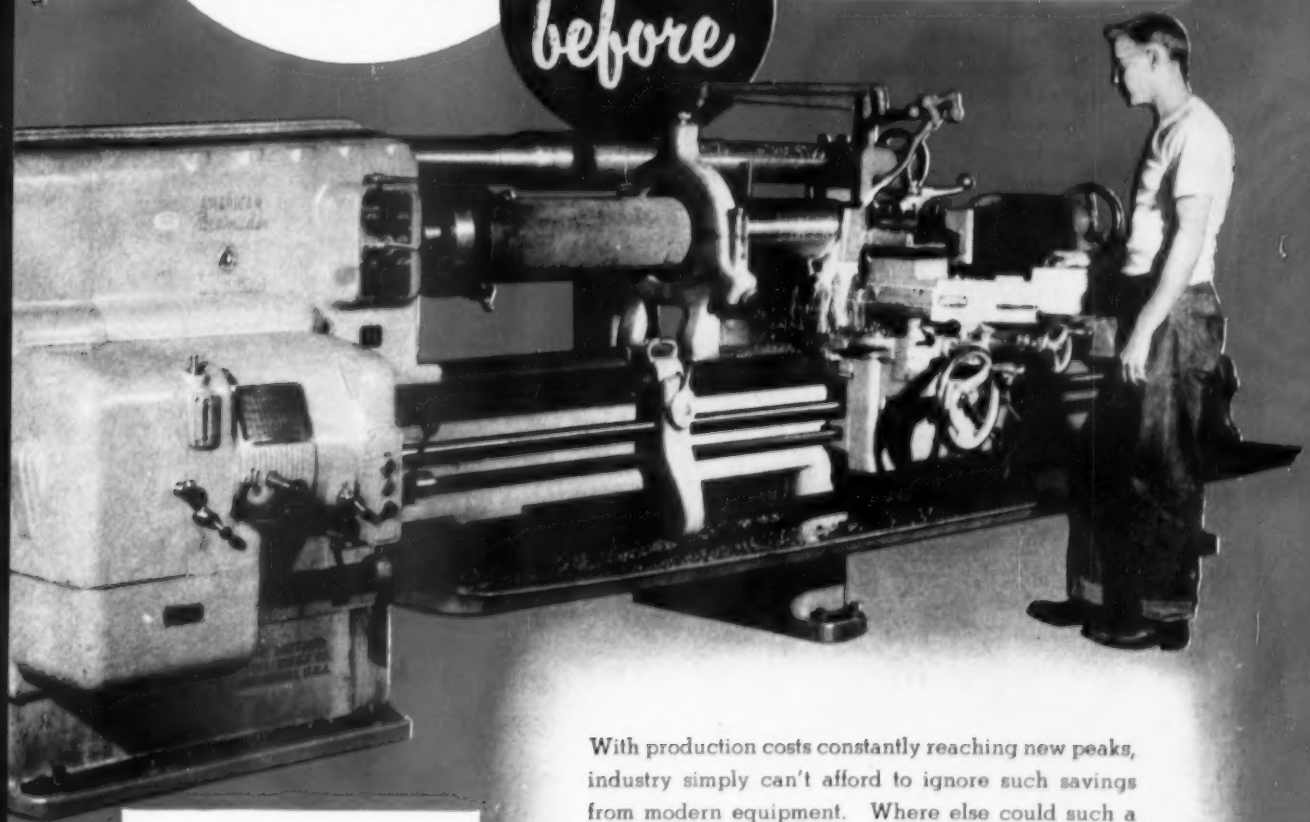
UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.
SPS
JENKINTOWN PENNSYLVANIA

2¼ hrs. now

9 hrs. before

Fairbanks, Morse & Co., Beloit, Wisconsin, is *really* putting the payroll dollar to work with its new 20 inch "AMERICAN" Heavy Duty All-Hydraulic Duplicating Lathe.



2000 horse power Fairbanks-Morse motor shafts are now being rough and finished turned in 2¼ hours floor to floor against a former time of 9 hours per shaft.

With production costs constantly reaching new peaks, industry simply can't afford to ignore such savings from modern equipment. Where else could such a magnificent return upon an investment be secured, and how else can costs be lowered to meet an increasingly competitive market?

More production per man hour is the answer and the only answer to prohibitive costs—modern, high production machinery is the answer to greater production per man hour.

Put your payroll dollar to work for greater profits with "AMERICAN".

Bulletin No. 35 shows many examples—it's yours for the asking.

THE AMERICAN TOOL WORKS CO. **Cincinnati 2, Ohio, U. S. A.**

LATHES AND RADIAL DRILLS

MICROHONING*

Generates . . .

ACCURATE, ROUND, STRAIGHT SURFACES

Truly round, straight surfaces are generated by the application of fundamental principles on which the Microhoning process and equipment design are based:

The combined reciprocating and rotating motion of the tool act on the full length of the bore on every stroke.

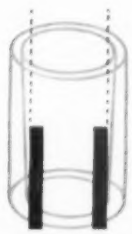
The self-dressing abrasive assures sharp grits and cutting at all times.

The tool and bore automatically align themselves.

The feed-out of the tool is positive with equal pressure in all directions from the center line.

All out-of-roundness is removed by the expanding abrasive "cylinder" formed by the rotating tool. Only the tight areas are abraded until all areas have the same radius from the axis.

Wavy or snaky surfaces are made straight by the long abrasive sticks shearing off the crests of the waves.



In tapered bores the abrasives cut only in the tight area until the cylinder has the same diameter throughout its full length.

ACTUATING LEVER

Steel Forging • 58 to 60 Rockwell "C"

Bore out-of-round and tapered .0015 to .0025 inch.

Microhoning reduces error to less than .00015 inch

Removing approx. .005 inch stock

Production—130 pieces per hour

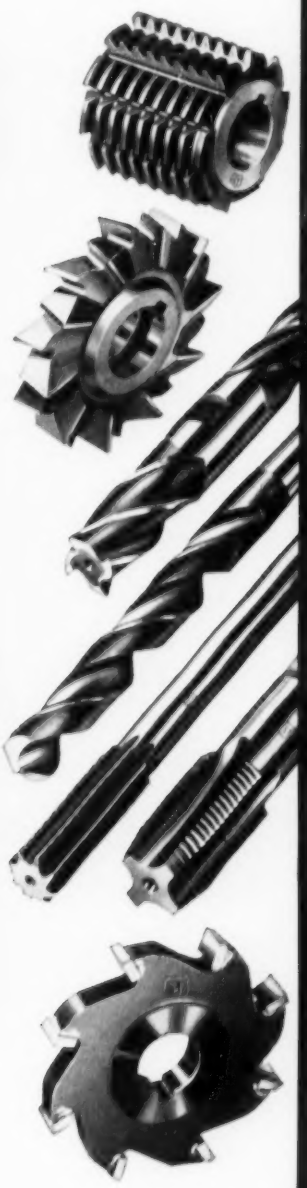
Machine—Model 705-2 Hydrohoner

***MICROHONING – Stock Removal + Geometry + Size Control + Surface Finish**

MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

Standardize with STANDARD



STOCKED BY THE STANDARD DISTRIBUTOR IN YOUR AREA

SERVING INDUSTRY 75 YEARS 1868-1943

● When you're faced with a cutting tool problem, the STANDARD TOOL MAN—backed by 75 years of industrial experience—will recommend a practical, profitable solution.

Your Standard Tool Man is familiar with all types of metal-cutting operations and is always at your service without obligation.

Call him!

STANDARD TOOL CO.

3950 CHESTER AVENUE · CLEVELAND 14, OHIO

STANDARD TOOL CO.

FACTORY BRANCHES IN: NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Carbide-Tipped Tools · Gages*

Speed up the job with

ROTOR
ASSEMBLY TOOLS

LIGHT... POWERFUL
a type and size
to suit your needs
AIR-POWERED
REVERSIBLE
NON-REVERSIBLE
SCREWDRIVERS · NUTSETTERS
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J-4S
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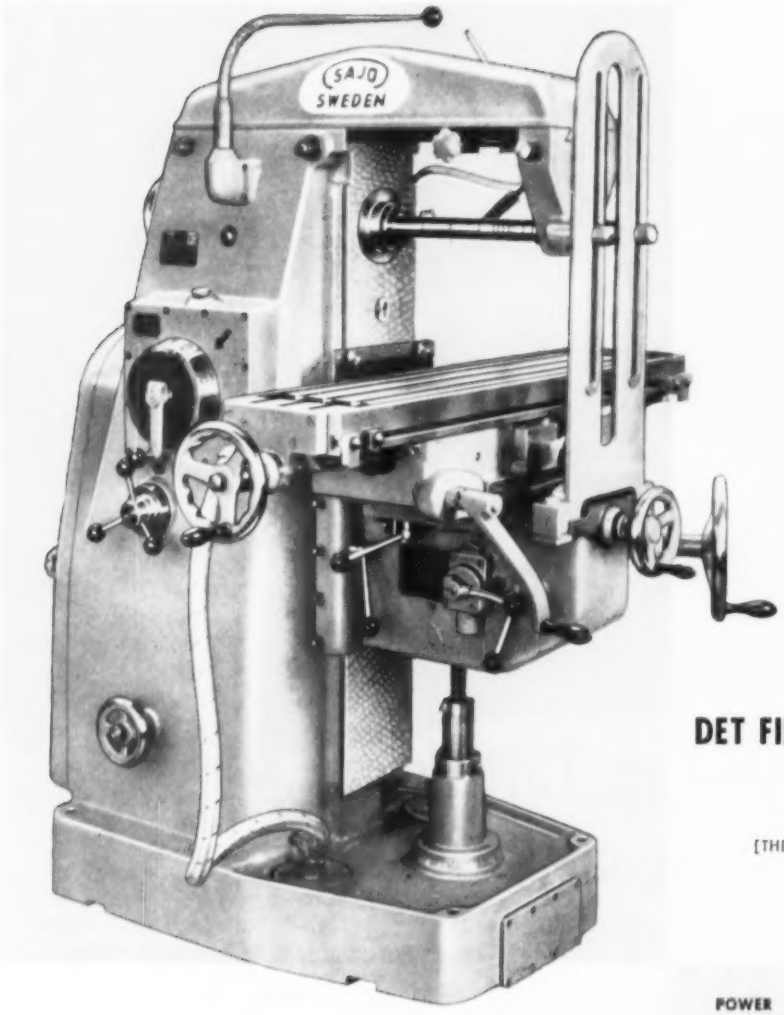
E-ORA M1108
S-02PRC
E-O M1106
E-20 M859
S-02LA
S-02LRC
S-02LRSA
E-834 M9073

● Write for Bulletin 53 giving specifications on these assembly tools and on the complete line of Rotor Tools for all industry. The ROTOR TOOL Company, Cleveland 32, Ohio.

ROTOR TOOLS®
CLEVELAND, OHIO

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS



• SAJO MILLING MACHINE MODEL #53

DET FINNS INGEN ERSÄTTNING FÖR KVALITET

[THERE IS NO SUBSTITUTE FOR QUALITY]

Sajo builds for accuracy to tenths and dependability that assures profitable production. Built to U.S. Standards, initial cost and maintenance are considerably less than comparable first quality millers.

Sajo light duty #2 Milling Machines are available in 2 models both as Plain and Universal types. Plain miller prices are:

Model 53 (illustrated) All Geared	$5,365
Model 49 Back Geared, with enclosed belt drive	$4,110

Both built to same standard of accuracy.
Example: Spindle run-out at end of 12" mandrel = .0008".

POWER

3½ HP

RANGE

Model 53 — 16 spindle speeds 39 to 1500 RPM

Model 49 — 12 Spindle speeds 36 to 1540 RPM

#40 NMT spindle, 12 table feeds.
Table travel: Long, (Universal) 27½", (Plain) 24"; Cross 8¼"; Vertical 18".

CONTROLS

Model 53 — single adjustable Start-Stop-Brake lever. Dial selection of speeds and feeds with single lever control.

Model 49 — push button control.

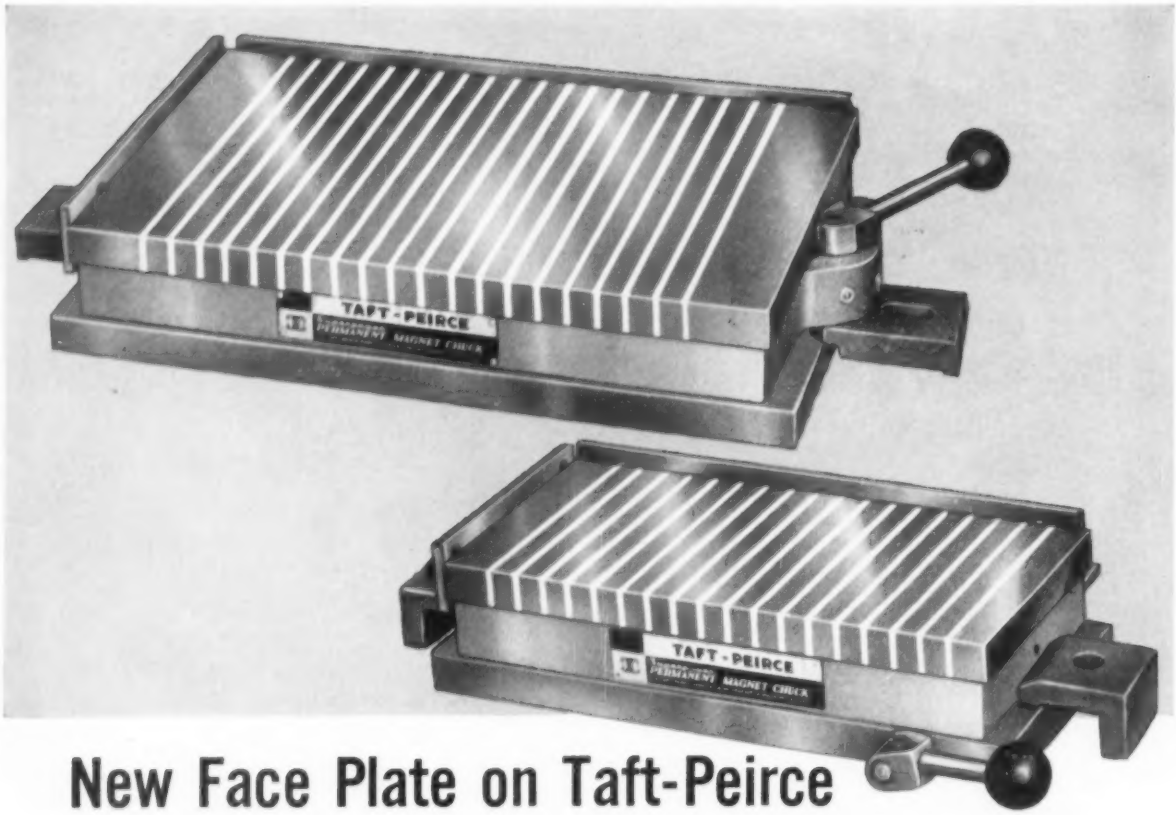
Both models with magnetic motor starters, feed screws and dials to U.S. Standards.

FOR INFORMATION, CATALOGS, AND REFERENCE DATA, WRITE

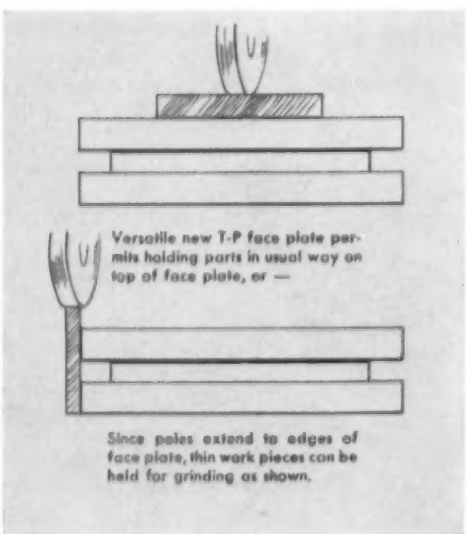
austin INDUSTRIAL CORPORATION

76F MAMARONECK AVENUE • WHITE PLAINS, NEW YORK

DEALERS IN PRINCIPAL CITIES • LOOK FOR THE AUSTIN SEAL . . . YOUR FULL GUARANTEE OF SATISFACTION



New Face Plate on Taft-Peirce Permanent Magnet Chucks



Versatile new T-P face plate permits holding parts in usual way on top of face plate, or —

Since poles extend to edges of face plate, thin work pieces can be held for grinding as shown.

Increases Capacity Simplifies Setups

Now lower, longer, and stronger T-P Superpower Permanent Magnet Chucks offer you more surface plate area to work with. Poles extend to edges of face plate to eliminate waste space and dead spots.

15 to 20% lower in height than other Permanent Magnet Chucks, these Superpower Chucks give you more clearance between wheel and chuck.

Since poles extend the full width of face plate, sides of chuck can be used for grinding edges of thin sections. Simplifies complicated setups.

In addition, a Superpower P-M Chuck has more magnetic poles for its size — gives you a greater effective working length.

Extra-sturdy construction assures maximum dependability, minimum maintenance. Now available in a range of standard sizes. Also in sine angle chuck models. Specials on request. Write for more information.

PERMANENT MAGNET CHUCKS | RECTANGULAR ELECTRO-MAGNETIC CHUCKS | ADJUSTABLE ELECTRO-MAGNETIC CHUCKS | ROTARY ELECTRO-MAGNETIC CHUCKS

T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

How to IMPROVE your production BATTING AVERAGE

You'll lead the league when you switch to CIMCOOL*, the radically new and different cutting fluid. Here are three ways that CIMCOOL Standard Concentrate can improve your production batting average:

- **CIMCOOL LOWERS COST** because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.
- **CIMCOOL IMPROVES TOOL LIFE** because of its chemical lubricity. It permits faster speeds and feeds, for it combines friction reduction and cooling capacity in a degree never before attained by old-fashioned coolants.
- **CIMCOOL IS CLEAN,** doesn't soil clothing or hands. It contains no skin irritants. It leaves no slippery film on shoes, floors, machine or work. It can't smoke, can't burn, and virtually eliminates rancidity and foul odors.

For full details on CIMCOOL Standard Concentrate—and on the entire family of CIMCOOL Cutting Fluids—just contact us. Wire, write or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

*Trade Mark Reg. U.S. Pat. Off.

CIMCOOL CUTTING FLUIDS

CIMCOOL **Concentrate**—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMCOOL **Tapping Compound**—Permits the use of highest tapping speeds and increases tap life amazingly.

CIMPLUS The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT **Base Additive**—For jobs requiring an oil-base cutting fluid. Added to mineral oils, it gives an economical mix for higher speeds and feeds.

CIMCOOL **Bactericide** — The most effective agent yet developed to overcome rancidity and foul odors.

CIMCOOL **Machine Cleaner** — The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

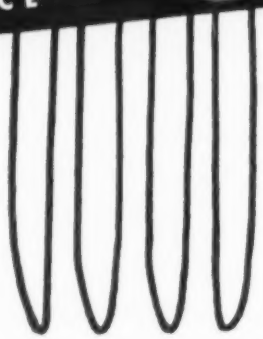
CIMCOOL Cutting Fluids

for 100% of all metal cutting jobs

PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

DROODLES

by ROGER PRICE



Bench Model BC-7D

Floor Model FC-30

Floor Model FC-14

"POTATO'S EYE VIEW OF A FORK"

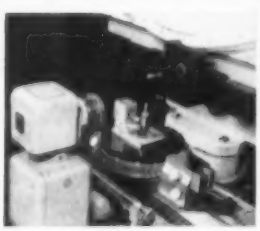
This Droodle presents several fascinating possibilities. Turned upside down, the title could be "Yeast-cake Quartet Rising to the Occasion". Best of all, though, I'd like to add little squiggly lines, and call it "Tines getting in Tune". But squiggle-drawing makes me nervous. Gee, I wish I were normal! But if I were, then my psychiatrist wouldn't have that shiny new Continental. Just goes to prove that every problem has a silver lining.

If *you* have a problem . . . concerning quality control inspection . . . here's *your* silver lining: the J & L Optical Comparator. It's an incredibly flexible precision inspection instrument that inspects and measures all sorts of parts and objects.

The J & L Comparator not only is a great aid in production-line inspection, it is also ideally suited to job-shop work. It's versatile, *easy* to operate, accurate to .0001", and makes speedy inspection a cinch. Eleven models available. Send coupon now for full information.

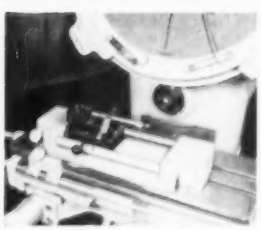
JONES & LAMSON OPTICAL COMPARATORS

Precise . . . Rapid . . . Flexible . . . Easy to operate



A J & L Comparator, with special fixture and chart, easily and perfectly measures a 3-dimensional cam. This is traditionally one of the most difficult of inspection jobs.

This inexpensive J & L Comparator is precisely measuring four small parts, of different sizes, with the same setup.



A J & L Comparator can measure shoulder lengths to closest tolerance, swiftly and accurately. The fixture shown here accommodates a wide variety of parts.

JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 502 Clinton Street, Springfield, Vermont, U. S. A.

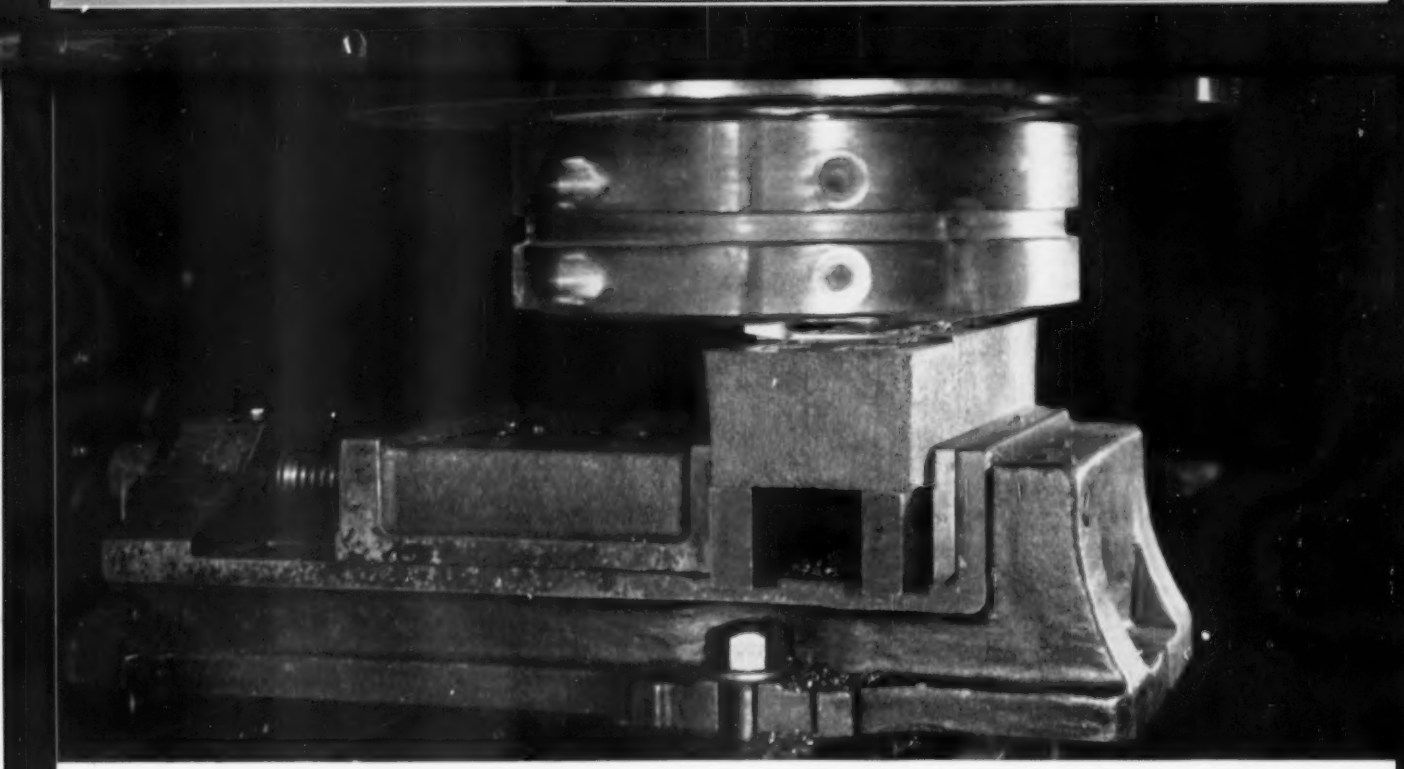
Please send me Comparator Catalog 402-C, which describes the complete J&L line of optical comparators.

name _____ title _____

company _____

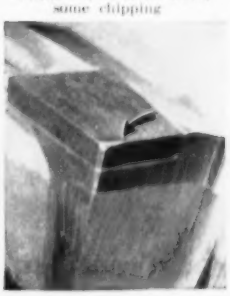
street _____

city _____ zone _____ state _____



Grade 860 – .012" wear, no chipping

Grade "A" – .035" wear, some chipping



Grade "B" – .025" chipped

Wear land comparison tests prove Grade 860 provides greater resistance to chipping, cratering. After milling 72¾ lineal inches on a cast-iron block with interrupted cuts to simulate cylinder blocks, wear on Grade 860 is minute. Two typical carbides tested under identical conditions show extensive chipping. **Speed** – 377 fpm. **Feed** – .0096". **Table travel** – 1¼ ipm. **Depth of cut** – .100".

On high-tensile gray cast irons . . .

TOUGH, NEW CARBOLOY MILLING GRADE 860 GREATLY REDUCES CHIPPING AND CRATERING

Carboloy® Milling Grade 860 was specially developed to provide longer tool life on the harder, denser types of gray cast iron now coming into common use.

Stronger cutting edges make Grade 860 far more resistant to chipping and cratering than any other available carbide. Tougher internal structure provides longer tool life and more production per grind.

Improves production 20-30%

Carboloy Grade 860 has been tested for almost a year on high-tensile cast irons ranging from 223 to 248 Brinell hardness. Despite scale and interruptions, this new carbide has consistently outperformed ordinary grades by 20-30%.

At speeds ranging from 250 to 300 fpm, Grade 860 produces excellent finishes. It is especially efficient for face milling operations, and can also be used to advantage for plain milling.

Specify new Carboloy Grade 860 for your milling cutters. For more details or technical information, write today . . . or mail the coupon on page 4 of this advertisement.

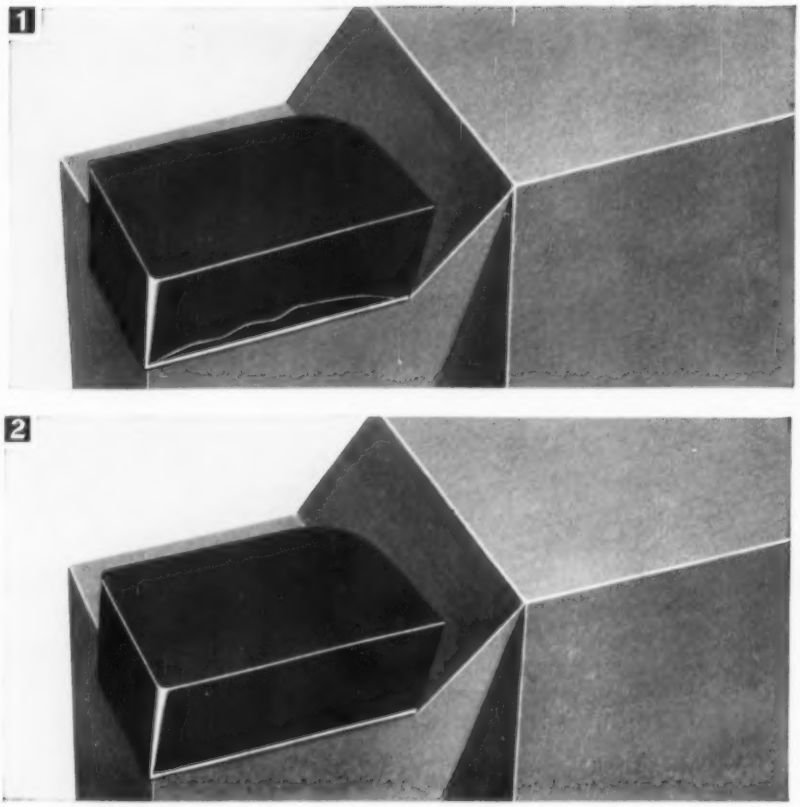
CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

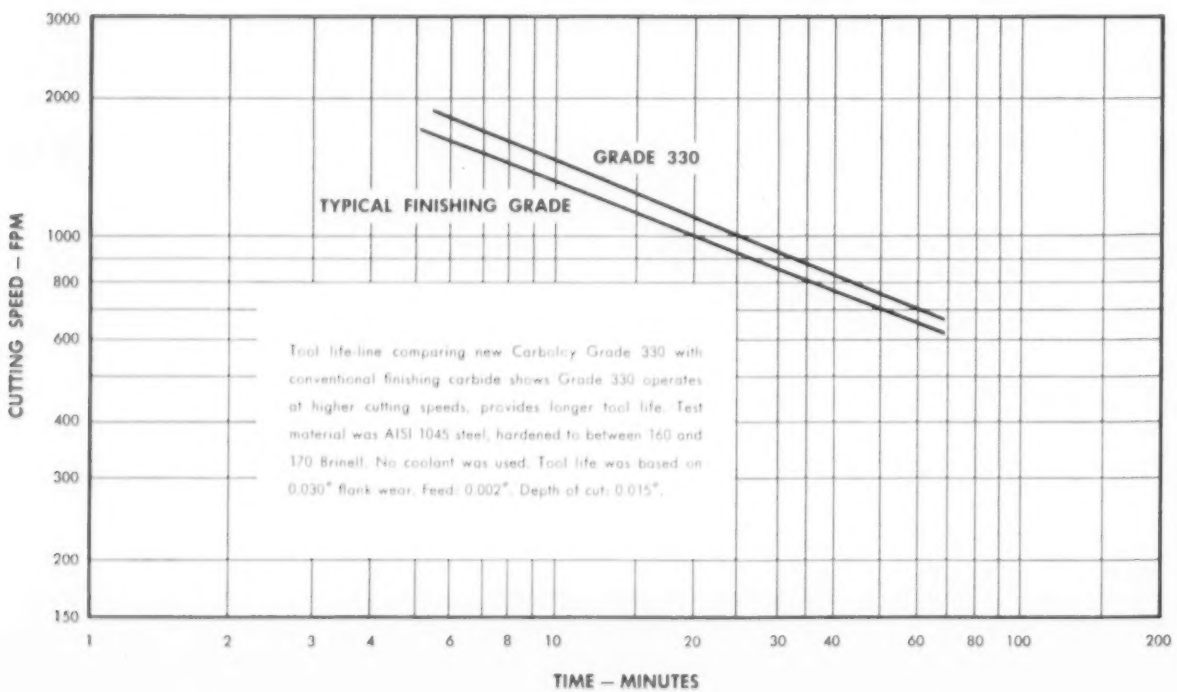
BRAZING CRACKS ELIMINATED

Conventional carbide (Figure 1) shows type of brazing crack that can greatly reduce tool life and increase machining costs.

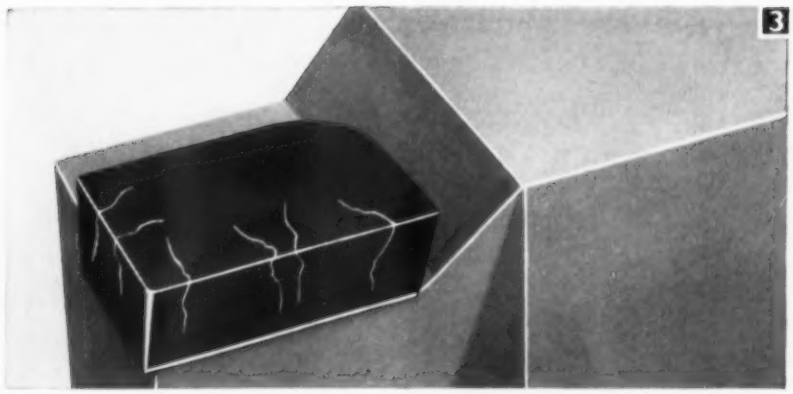
Carboloy Grade 330 (Figure 2) uses nickel binder to provide greater strength and toughness to resist brazing strains. For further protection, the wholly new composition of Grade 330 permits the use of high-silver solders with lower melting points. (Photos have been retouched to bring out brazing cracks difficult to see with the naked eye.)

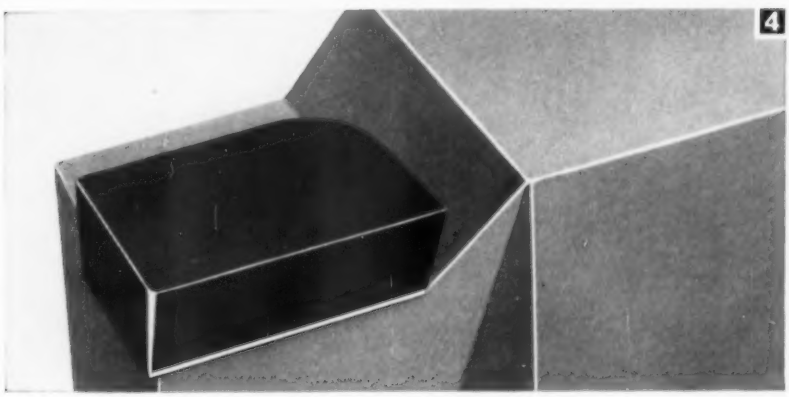


NEW CARBOLOY STEEL-FINISHING GRADE 330



Tool life-line comparing new Carboloy Grade 330 with conventional finishing carbide shows Grade 330 operates at higher cutting speeds, provides longer tool life. Test material was AISI 1045 steel, hardened to between 160 and 170 Brinell. No coolant was used. Tool life was based on 0.030" flank wear. Feed: 0.002". Depth of cut: 0.015".





GRINDING CRACKS ELIMINATED

Ordinary steel-finishing carbides are so brittle that grinding cracks (Figure 3) frequently appear. Automatic grinders cannot normally be used.

Because Grade 330 (Figure 4) has twice the transverse rupture strength of ordinary carbides, it has superior resistance to grinding cracks, can be easily ground on duplicating-type grinders. (Photos have been retouched to bring out grinding cracks difficult to see with the naked eye.)

MACHINES FASTER, WEARS 20-35% LONGER

- **Easier to braze and grind**
- **Double transverse rupture strength**
- **More resistant to chipping, cracking**

With a transverse rupture strength of 200,000 psi, new Carboloy Finishing Grade 330 is nearly twice as strong as conventional steel-finishing carbides.

Used on finishing and boring jobs, this extra strength means greater resistance to chipping and cracking, along with improved tool life.

Entirely new composition

The secret of Grade 330 is its higher titanium-carbide content and nickel binder. Grade 330 is tougher, easier to grind, and more wear resistant than cobalt-binder grades.

Production tests on AISI 1045 steel (see chart at left) show Grade 330 can be operated at speeds 10% higher than other carbides without any loss in tool life. When compared at speeds ranging from 600 to 1900 fpm, Grade 330 consistently provided 20-35% longer tool life than other grades.

Extra-performance steel-cutting carbides

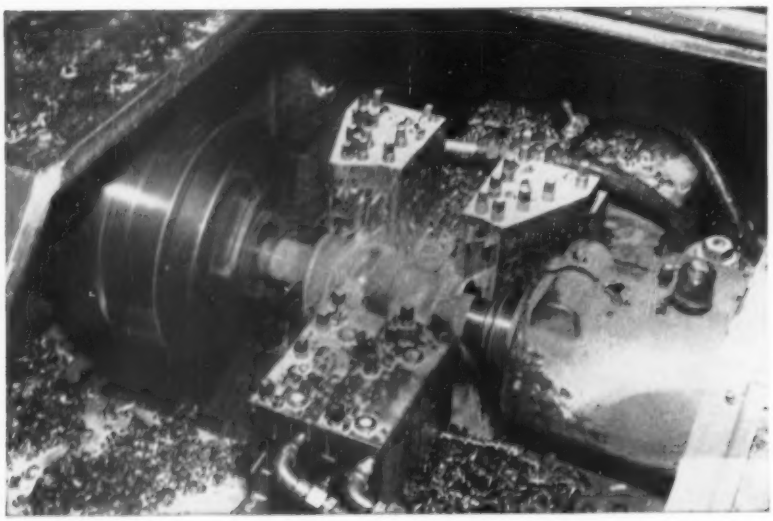
Grade 330 rounds out the Carboloy extra-performance Series 300 carbides (Grades 350, 370), taking up on finishing and boring where Grade 350 leaves off.

Throw-away inserts, standard blanks, square and solid boring tools are now available from Authorized Carboloy Distributors. For price list and specifications on Grade 330, send the coupon on page 4 of this advertisement.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

GET MORE OUTPUT FROM YOUR MACHINES WITH CARBOLOY GRADES 350 AND 370

▶ Remove more steel per minute ▶ Reduce downtime and tool costs



Edwards Valve Division, Rockwell Mfg. Co., found that interrupted cuts on 207 Bhn steel limited production to 25 pieces per edge with former carbide. After switch to Grade 370 inserts, production jumped to 40 . . . an increase of 60%.

SETUP: Material – 4140 forged steel. **Speed** – Over 400 fpm. **Feed** – 0.009". **Depth** of cut – ¼" to ½".

Carboloy Grades 350 and 370 are *extra-performance* carbides. They are specifically designed to take heavier, deeper cuts at faster speeds . . . to provide maximum machine output at lowest tool cost.

Hundreds of in-plant case histories like the one above have proved Grades 350 and 370 consistently outperform, outwear all other steel-cutting carbides.

Greatly increase output

Even on the toughest jobs, these carbides have brought production increases ranging from 30% to 300% . . . reducing the cost per finished piece.

Carboloy Grades 350 and 370 have a built-in structural rigidity that resists edge deformation even at temperatures as high as 1800° F. Their ability to stay on the job longer means less downtime, more production from the machine.

Complete stocks available locally

Try medium-duty Grade 350 and heavy-duty Grade 370 on your steel-cutting jobs . . . and lower your tooling costs.

Your local Authorized Carboloy Distributor maintains complete stocks of both these grades in a wide range of tools, blanks, and inserts. His name is listed in the Yellow Pages of the phone book. For more information, call him today or mail the coupon below.

CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

11149 E. 8 Mile Blvd., Detroit 32, Michigan

Send me more information on:

- ☐ New Milling Grade 860
- ☐ New Finishing Grade 330
- ☐ Grades 350 and 370
- ☐ Send the name of the nearest Authorized Carboloy Distributor

Name _____

Title _____

Company _____

Address _____

City _____ Zone _____ State _____

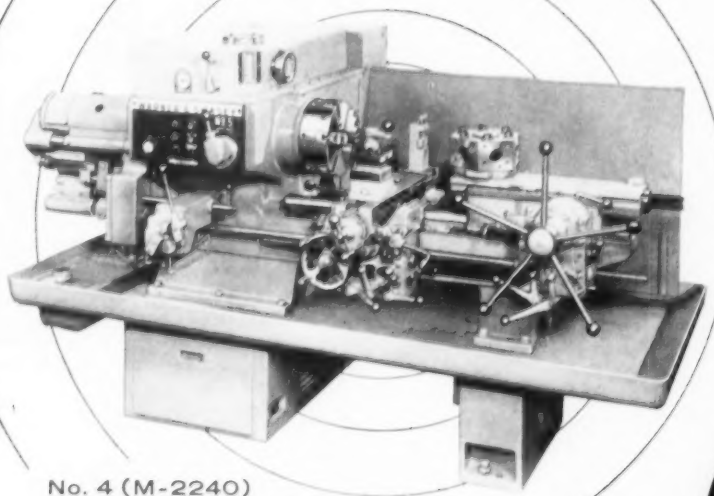
"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

On new Warner & Swasey No. 4 and No. 5 Turret Lathes with new all-hydraulic headstock...

YOU CAN CHANGE SPEEDS

FASTER THAN YOU CAN

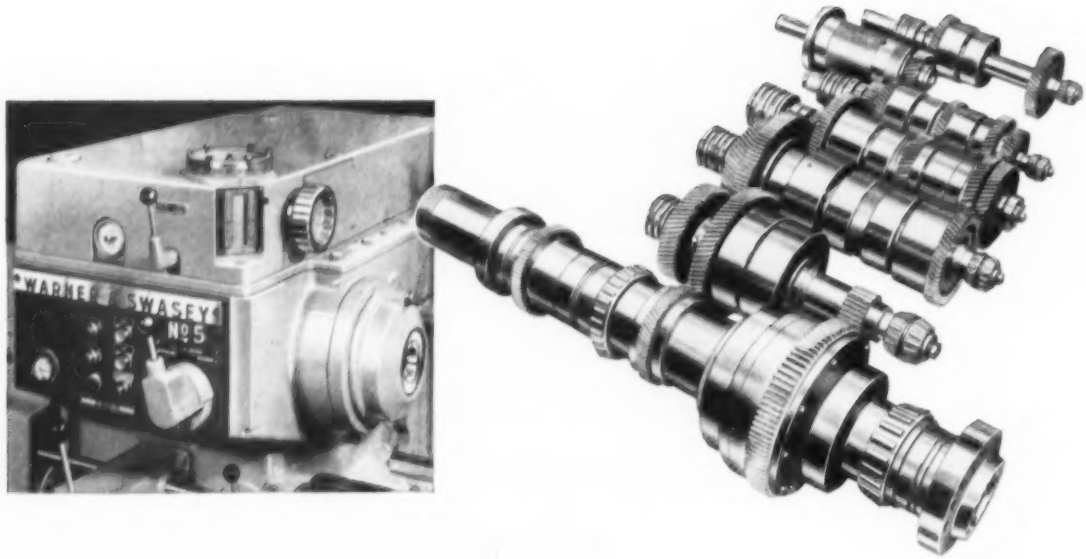
TURN THIS PAGE!



No. 4 (M-2240)
2" Bar Capacity—18⅛" Swing

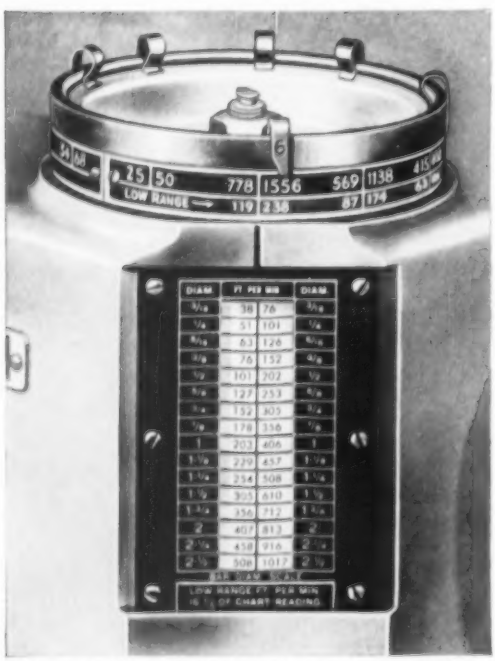
No. 5 (M-2250)
2½" Bar Capacity—20" Swing

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880



INSTANTANEOUS SPEED CHANGES

WITH THE FLIP OF A LEVER



Warner & Swasey's direct-reading, patented speed preselector is calibrated in work diameter, surface feet, and spindle rpm's—which, with the new ease of changing speeds, encourages the operator to use the proper spindle speed.

DIRECT-ACTING hydraulic clutches, with a constant-mesh gear train, eliminate all gear shifting on these new Warner & Swasey Ram Type Turret Lathes. Clutches engage smoothly and quickly, providing fast starts, stops, and reverses. Clutches never need adjustment.

With the patented speed preselector the operator can select a new spindle speed while under cut and with a mere flip of a lever, change speeds instantly.

A flip of the speed change lever in the opposite direction provides a valuable 6 to 1 speed reduction for threading or forming cuts—instantly and without preselection.

A total of 12 spindle speeds, or 24 unduplicated speeds with a two-speed motor, are available on these new machines. A touch of a button doubles or halves the speed, and when used in conjunction with the 6 to 1 speed change, four spindle speeds are instantly available with only one setting of the preselector.

A separate master lever controls forward, reverse, brake and neutral. *Zoned controls* on headstock and apron put them all within easy reach of the operator—cutting fatigue, speeding his work, putting more pieces on the floor every hour of every day!

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

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...and among high speed steels

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Crucible REX® high speed steel has been the winner in shop tests for more than fifty years. *And now REX is even better than ever!* For Crucible research and experience has led to improved manufacturing techniques that mean higher quality – greater uniformity.

Prove the superiority of REX for yourself – on your next job. Check it for size, structure, response to heat treatment, all-around tool performance. Then you'll know why REX has always been the *standard by which other high speed steels are compared.*

REX is immediately available at all of Crucible's convenient warehouses – or through prompt mill delivery. For a list of available data on REX and other Crucible *special steels*, write for a free copy of the "Crucible Publication Catalog". *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

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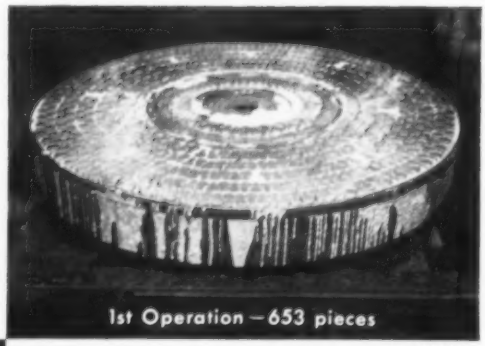
Another example



1st Operation—653 pieces

W-1138

2nd Operation—44 pieces

W 1139

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653 oddly shaped, non-magnetic workpieces

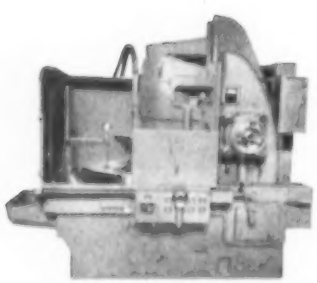
Blanchard Surface Grinders are noted for their unusual versatility—like grinding small, non-magnetic stainless steel forgings in quantity.

In the first operation, 653 forgings are loaded and blocked between rings on a No. 18 Blanchard, with 36" magnetic chuck (stock removal .010"). Parts, chuck and rings are sprayed with oil, and molten sulphur is poured around the parts to hold them. After grinding, the sulphur is easily stripped away.

This entire operation takes only 1½ hours—including preparation of the sulphur.

In the second operation, 44 pieces are set in a notched steel ring. Tilting the wheelhead and maintaining wheel pressure in one direction holds these non-magnetic pieces in the notches. Stock removal from this surface is .030", to tolerance of ±.003. Each load takes eight minutes—floor-to-floor.

As a result of this ingenious workholding, each piece is ground on both sides in a fraction of a minute, at less than 98¢ abrasive cost for all 653! That's typical of the convenience and economy of grinding on a Blanchard—whether the parts are magnetic or non-magnetic!



Send for free copies of "Work Done on the Blanchard", 4th edition, and "The Art of Blanchard Surface Grinding", 3rd edition—recently revised.

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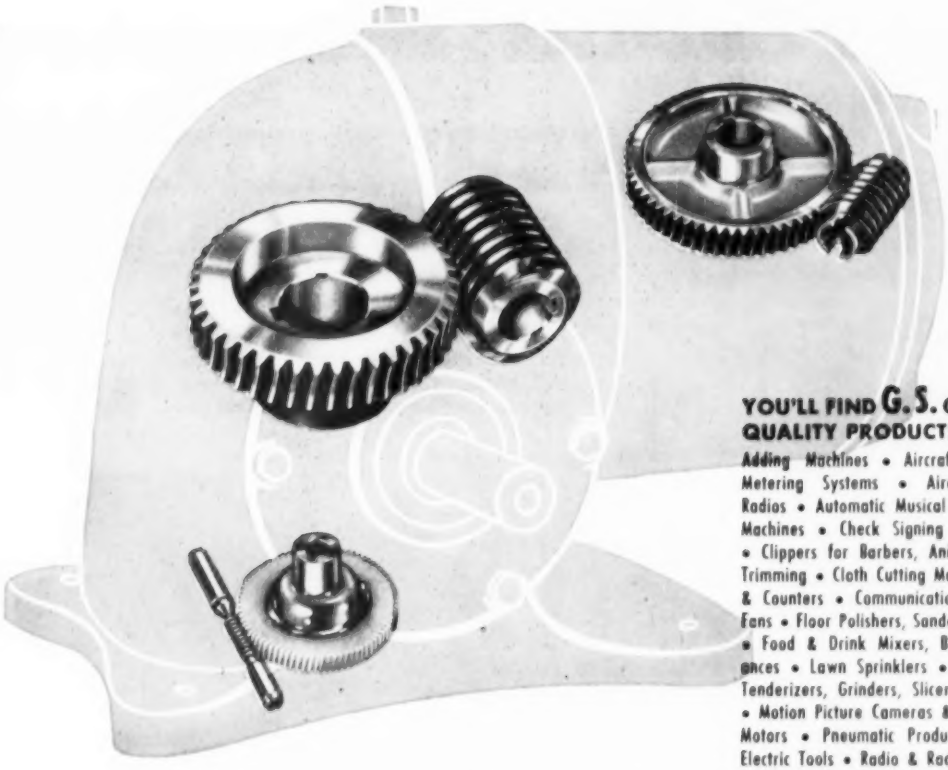

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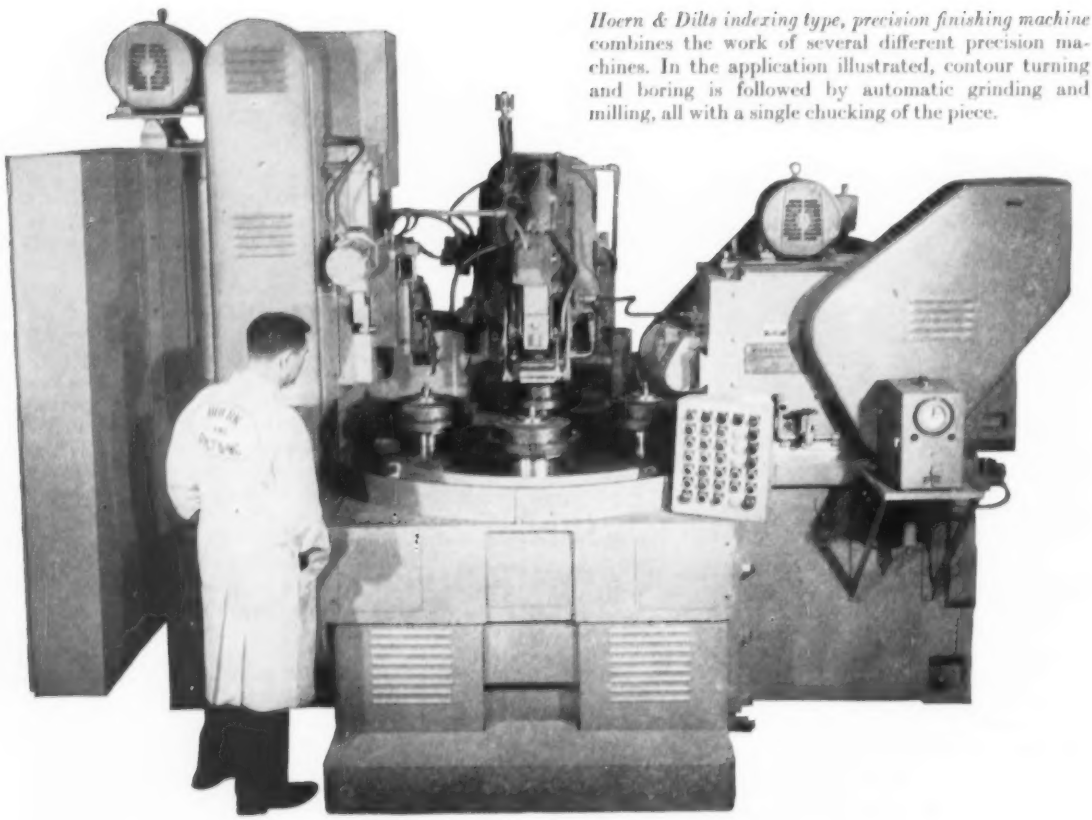

Hoern & Dilts indexing type, precision finishing machine combines the work of several different precision machines. In the application illustrated, contour turning and boring is followed by automatic grinding and milling, all with a single chucking of the piece.

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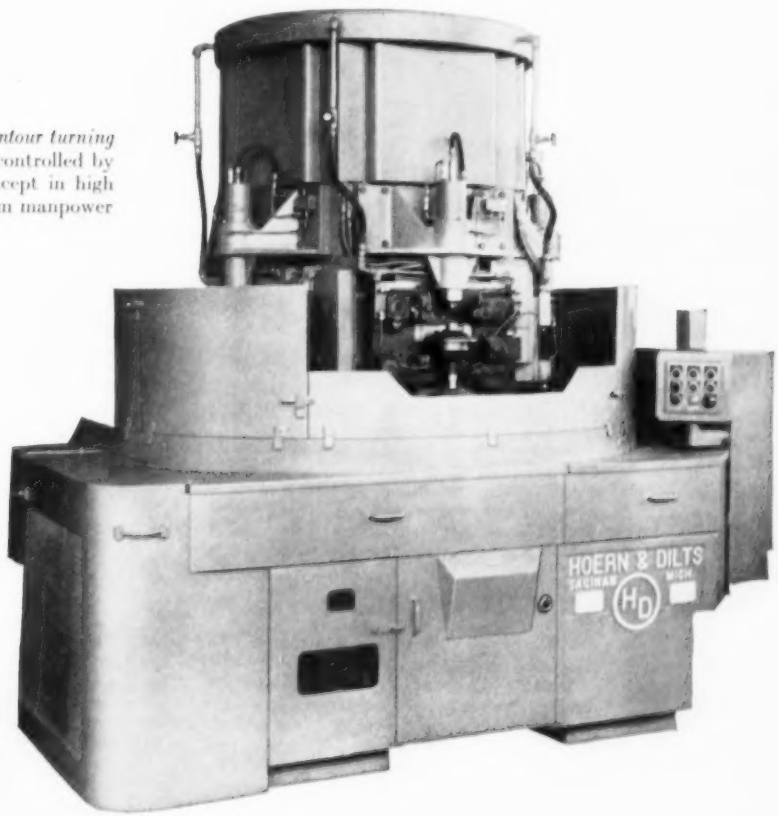
MACHINE COMPANY

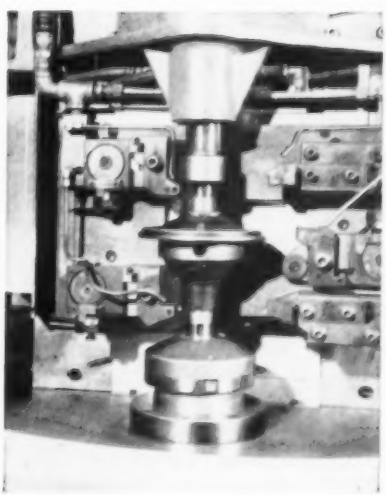
In ten years Hoern & Dilts has become a leader in developing machines for increasing productivity-per-man—by duplicating *the same* operation on five or ten spindle continuous machines, or by performing many *different* operations on multiple column indexing machines.

Now the extensive engineering and manufacturing resources of The New Britain Machine Company are placed at the service of Hoern & Dilts customers.

Write The New Britain Machine Company, Hoern & Dilts Division, Saginaw, Michigan, or consult your New Britain representative for information and literature.

Hoern & Dilts continuous type precision contour turning and boring machine. Five sets of spindles controlled by a single set of cams introduce a new concept in high production of precision pieces . . . maximum manpower utilization without operator fatigue.





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A DIVISION OF
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YOU GET A

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Probe-Type Inspection Machine

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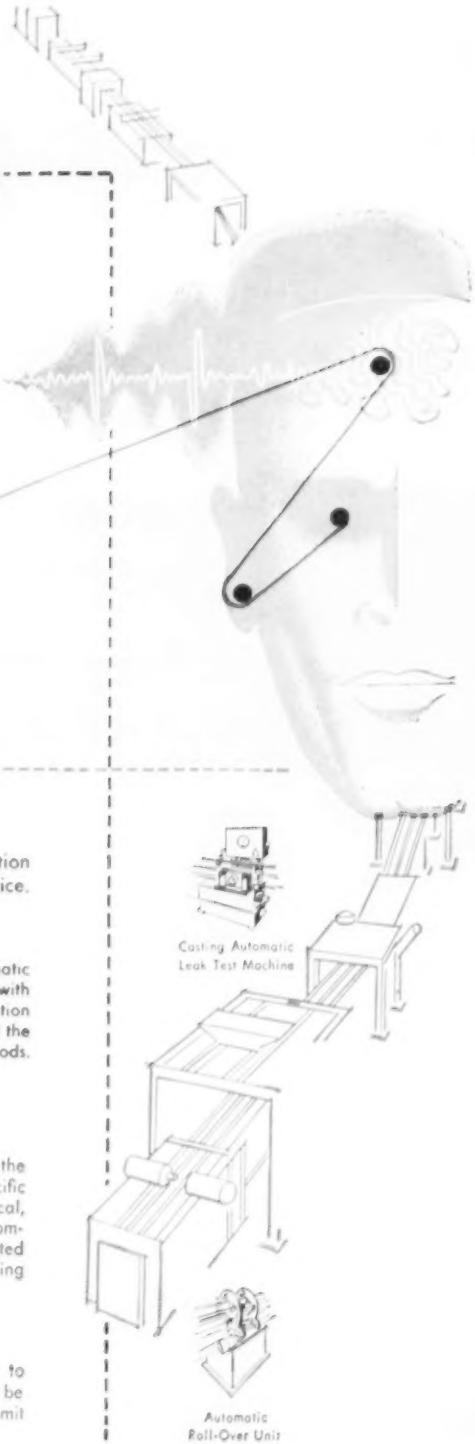

Now to better serve your needs and help you solve automation problems quickly, Barnes offers a two-fold coordinated service.

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Find out today why more and more Production Executives are turning to Barnes for a practical solution to their automation problems. We will be pleased to analyze your requirements, offer recommendations, and submit a cost estimate in a formal proposal if you so desire.

Casting Automatic Leak Test Machine

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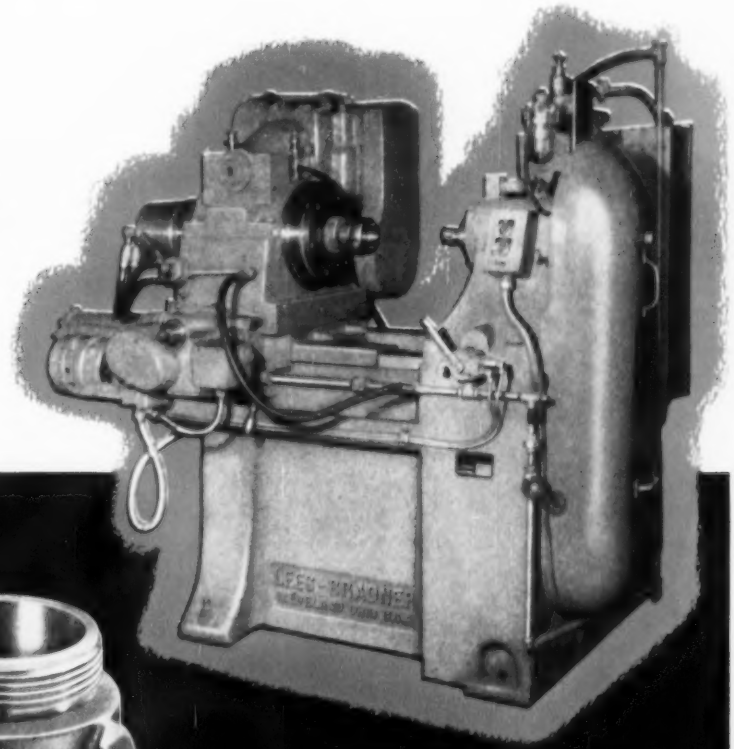
It took this HIGH-SPEED Heavy-weight to lick this tough job!



The Lees-Bradner Special High Speed Thread Milling Machine

The Lees-Bradner Special Thread Milling Machine really shows its class when it works with brass!

The Akron Brass Manufacturing Company of Wooster, Ohio produces these threads, internal and external, each in 13 seconds with a 5000 RPM cutter spindle speed.

This is just one example of the many threading jobs that the modern, high speed, Special Thread Milling Machine can do better, faster and with unmatched precision.

Write The Lees-Bradner Company for full information on this remarkably versatile machine.

DETAILS ON THIS JOB

Hob Spindle Speed, 5000 R.P.M.
(Using a high speed cutter spindle)

Thread Pitch (internal and external)	7½
Thread Diameter	3"
Length of Thread	¾"
Threading Time	13 seconds
Material	Brass
Weight of Parts	
Internal thread	1 lb. 13 oz.
External thread	2 lb. 10 oz.

the LEES-BRADNER Company

CLEVELAND 11, OHIO · U.S.A.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

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The basic design of the Dimensionair is different from that of any other Air Gage. It "repeats" measurements precisely and constantly hour after hour because —

1. The Dimensionair's balanced air system cancels out pressure variations which might affect it and cause errors.
2. Unlike other air gages, there is no adjustment in the magnifying-measuring side of the system. Rather than introduce a variable here which would make a fixed system impossible, Federal offers two magnifications which answer practically every requirement. These magnifications are 2500 to 1 and 5000 to 1. In this way, Federal achieves a stability which cannot be approached by other air gages.
3. Because the magnification is fixed, the scale is linear and the graduations can be accurately calibrated.
4. Hence, with no adjustment to change the magnification and affect the stability, only a single master is required.

Try It!

Check a Dimensionair yourself right in your own plant. Compare it with your present air gages.

a. **Check it for stability** or "repetition". Do this frequently and over long intervals, always using the same master. Avoid temperature effects (excessive handling, direct sunlight, etc.) Notice how quickly you can set the gage to zero.

b. **Check its calibration** using any number of masters. Confirm the fact that only one master is needed. See how dependable the Dimensionair really is.

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We'd like to test a Dimensionair in our plant.

Company Name

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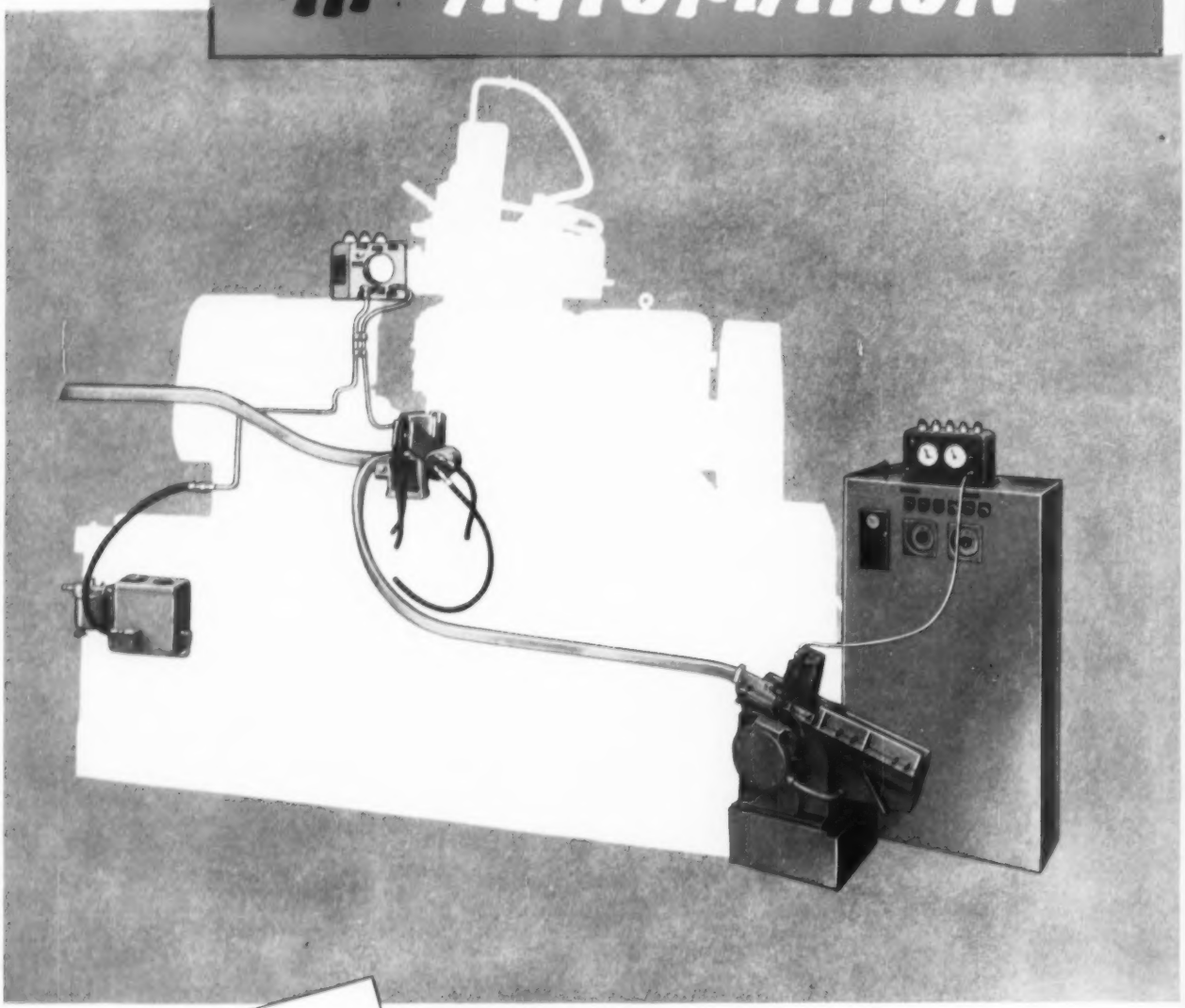
In AUTOMATION



Federal's Solution to the Cost of Gaging . . .
Impartial Gage Selection
Engineering Follow-Through
Everything in Gages

Combined Gaging permits close control of work size over long periods of time. To compensate for drift, etc., gage on the machine shifts its control point at the command of the after-gage (lower right) which originates signal when a prescribed number of pieces has exceeded marginal limits.

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FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

Gaging, too, FEDERAL goes the whole way

If you're ready to talk about . . .

Control on the Machine
Control after the Machine
Combined Gaging
Control for Non-Reference Variation
Control of Size for Predetermined Fit
Continuous Process Control
Control Point Compensation
Flagging Gages
Chute Gages

or other types and methods of automation gaging—

Automation has become a byword in plants today. It's easy to look upon Automation as the answer to every production problem. Being the first to treat Automatic Gaging so fully, however, we are well aware how helpful experienced advice can be in avoiding the mistakes and disappointments which often occur when complete automation is undertaken with *insufficient knowledge and too hasty planning.*

Close cooperation with machine tool builders has enabled us to successfully develop gages that conform to the capabilities of their machines. Our engineers provide various degrees of control on existing machines in the field and also work in close collaboration with machine designers to provide gaging and control units built into the manufacturer's original machines.

Many highly successful installations in daily operation demonstrate our practical knowledge in this field of gaging. We will welcome the opportunity to discuss your proposed automation when you first start your preliminary planning.

Our goal is the development of the one best automation gage for your job using mechanical, air, electric, or electronic gaging systems, whichever suits your needs best. Write or call us today.

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Includes many photographs and diagrams showing automatic gaging systems successfully employed in various industries. Full of valuable ideas — an important reference book.

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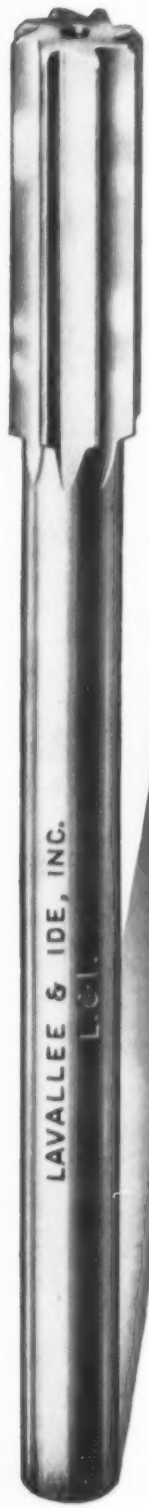

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Backlash

SEND LETTERS TO:
BACKLASH EDITOR American Machinist
330 W 42nd ST, N Y 36, N Y

Missing — One Zero

I read with interest the statement on molybdenum extrusion (*AM*—April 9 '56, p105). You have probably already noticed the typographical error which says that "molybdenum has been extruded recently at 300 F," instead of the 3000 F which it should be. This will probably be confusing to the reader, since molybdenum cannot effectively be extruded at such a low temperature.

Benjamin H Danziger
Climax Molybdenum Co.
New York, NY

Yes, we had noticed the typo, but only after the first copies were off the press and it was too late to make the correction.—Ed.

No Dream

I took a great deal of pleasure in reading your editorial (*AM*—Mar 26 '56, p95), and it does look as though Mr Cordiner's remarks are not just a mere dream but, my heavens, if we were to wait for our present unions to upgrade our men, I wonder when in the devil we would ever have it.

I am more than anxious to give the unions credit for the good things they have done, but they sure have a lot to learn yet, and there is a great field for improvement in the upper brackets of the various unions.

C H R
Detroit

Toolmaker or Just Machinist?

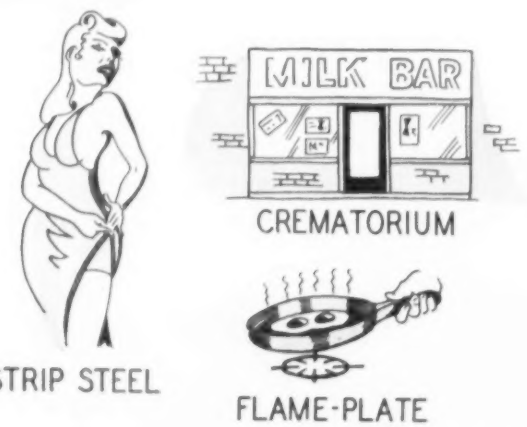
Perhaps you could help us with the following problem: We have extensive maintenance shops covering all trades (machinist, sheet-metal, pipe fitter, etc), with each group represented by a separate AFL union. We don't have a formal apprentice system, but bring in helpers. If they show promise, they are promoted to grade B Machinist.

After 18 months of automatic pay increases, they are held at B until the foreman decides to promote them to Machinist A class, after which there is another 18-month progression of pay increases. There is no automatic promotion from machinist to toolmaker.

The shop has the appearance of a toolroom, being air-conditioned. The machine tools are relatively small, including a jig borer and a gear hobber. Most of the work consists of building equipment for manufacturing purposes, with the ma-

GRINETICS

By D G SMITH



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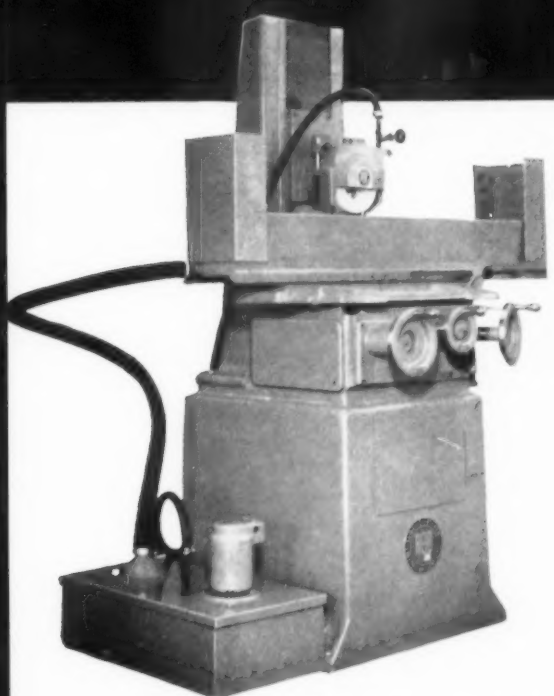
REID sets the standard for precision surface grinding...



MODEL 618H convenient finger-tip level controls for all operations make this grinder the favorite of the toolroom for the finest tool and die grinding. Accessories, including Cool-Grind or wet grinding attachments, magnetic chucks and form dressers give extreme versatility for all operations.

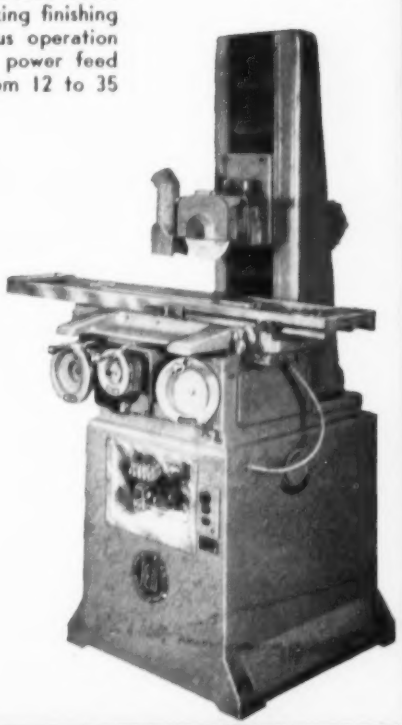
MODEL 618VL designed for precision grinding to the finest tolerances with superior surface finish . . . rugged construction and painstaking finishing give true dependability for continuous operation with minimum maintenance. Features power feed table with traverse speed variable from 12 to 35 feet per minute.

SPECIFICATIONS

CAPACITY: 6" wide, 18" long, 17¼" high from spindle center to table.
WORKTABLE: 51" x 8" overall.
FEED RANGE: Elevating hand wheel (r.) graduated to .0005" (optional, vernier to .0001"); cross feed to .001"; power cross feed adjustable .006" to .100" at either or both ends of table reverse.
GRINDING HEAD: with 3" opening for standard 1 h.p. cartridge type motorized spindle. Wheel size: 7" x ½" x 1¼".
FLOOR SPACE: 71" x 43½"
WEIGHT: 2100 lbs. net

Write for Bulletin 618-1

Photo courtesy of Robertson Mfg. Co.



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BEVERLY MASSACHUSETTS

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For half a century NOBLEWEST has been solving industry's marking problems . . . designing and building equipment for faster, better, *permanent* marking of metal products at lower cost. NOBLEWEST is the originator of the *Roll-Marking Process* and many other innovations in rapid production metal marking. In this, our 50th year, we derive great satisfaction from the knowledge that more and more leaders of industry continue to bring their marking problems to NOBLEWEST.

May we send you a copy of our new catalog containing the complete NOBLEWEST line of MARKING MACHINES and MARKING TOOLS? Just send us your name and title on your company letterhead.

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Noble & Westbrook Mfg. Co., 17 Westbrook Street, East Hartford 8, Conn.

chinists working from drawings. In our opinion the work requires a good machinist, both for the machine work and for assembling the units being built.

We do little punch and die work; but we do have a few toolmakers for special assembly work to close tolerances, and for making a few punches and dies.

Unfortunately, during the war some of the machinists were given toolmaker ratings to allow boosting their pay to keep them here; but they continued to do about the same grade of work. We are making a real effort to halt this practice; but once started, it's difficult to stop.

It would be of real aid to us if we had some concrete means of holding the line on this problem. First, we don't believe the work being done comes under the heading of toolmaking; and we also doubt that the men have the proper qualifications for toolmaking; they have never done what is normally considered in the trade as toolmaking.

Most of the gripes we get are from men who are 35-40, and have carried the Machinist A rating for 10 years or so. Unfortunately, most of them have not taken any additional related instruction since they received this rating, which might qualify them for the higher-paid toolmaker grade.

A H Sears
Rochester, N Y

We don't know of any regulations that would apply to this case, but perhaps one of our readers might be interested enough in the problem to steer Mr Sears onto some logical ammunition. Articles on training for toolmakers have appeared at various times (*AM*—April 26 '54, p156, Sept 13 '54, p145, Feb 14 '55, p137, June 6 '55, p137).

Skilled Men Needed—But

Your editorial "A Must — More Skilled Men" (*AM*—Dec 19 '55, p103) is very interesting, but it seems to me there are other important reasons why men have not been attracted to learn skilled trades.

They knew that as long as they would do that type of work, they would have to work under "factory standards." Factory standards meant long hours, no holidays, no vacation, and very strict regimentation.

It was not unusual, a few years ago, for a young typist who was working a 35-hr week to get a two-week vacation, all the holidays, and sick leaves, while in the same com-

pany an old toolmaker with 35 years of service had to work 50 hr a week, and he got docked if he once punched the time clock two minutes late. After 20 years of service he might be presented by the president with a gold watch with a "nice" inscription on it, but he never had much use for it because he never went anywhere. As skilled help, he had a special privilege when, once a year, the plant shut down to clean the boilers, and most of the employees were laid off; he was allowed to come in and work so he did not lose a week's pay. Also, he might earn more than the bookkeeper or bank clerk, and he could afford to get drunk after payday and sober up just in time to get back to work on Monday morning. But those advantages were not enough to have mothers encourage their sons to learn a trade.

Conditions have improved, but not enough to raise the social standing of skilled help to the level of office workers. That social standing is important was proved during the war when the name of "defense worker" made it easier for some people to go to work in factories.

More than higher wages, the 35 or 30-hr week, holidays, and longer vacations, and perhaps starting at 9 a.m. will raise the prestige of skilled help and more able men will be attracted to those jobs.

In the meantime, employers should try to eliminate artificial obstacles which prevent men from learning trades. Some of those obstacles are due to unions; others are the results of tradition. It is easier for a man to send his son to Harvard or his daughter to Vassar than to get them admitted to some unions unless he is a member.

There is also the "father and son" attitude and the clannish attitude which closes the door to many capable and willing men. Unfortunately, too many executives who should know better, tend to encourage those attitudes.

A man of 50 is not too old to learn if he is interested and willing but, in most factories, a man who is over 25 will find it very hard to get a chance to learn a skill. The attitude among foremen, and even management, seems to be that people who work with their hands can not, and should not, learn anything new after their early twenties.

I am a toolmaker, and the opinions I express were formed during the 16 years I have been working in a factory.

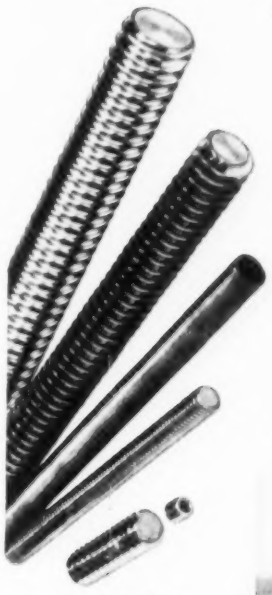
E P A
New York

REED

Thru-feed Thread Rolling

for Continuous Precision Threading of Long or Short Bars and Tubing and Short Headless Parts

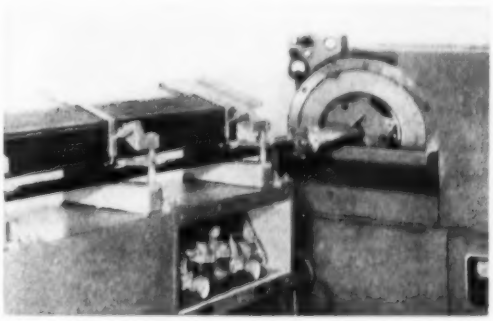
DIAMETER CAPACITIES—¼" to 3"



Hollow and Solid Parts Threaded by Thru-feed Rolling

REED MACHINES

Provide Uniform Pitch Diameter and Accurate Thread Form Over the Entire Length of the Threads



Thru-feed rolling may be used for threading both solid and hollow pieces of varying lengths and materials. Various forms may be rolled, including worms and Acme threads. Headless pieces, with threads running the entire length, may be threaded in bar lengths and then cut up into desired finished lengths.

Machines may be arranged for both manual and completely automatic loading and unloading of the parts . . . the rolling cycle with either method of loading is fully automatic. The work blank is rolled between cylindrical dies and is finally discharged at the rear of the machine. Short, headless pieces may be loaded into a chute and automatically fed, rolled and discharged. Controls are available that permit rolling the entire length, ends or middle section of a part.

Reed thread rolling machines are made in 2 die horizontal and 3 die horizontal and vertical types for thru-feed and in-feed rolling. They are rugged, of compact construction, easy to set up, convenient and simple to operate.

Operating handbooks are available so the tool engineer and operator can set up his own applications.

Write for Thread and Form Rolling Bulletin 159

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

WORCESTER 1, MASSACHUSETTS, U.S.A.

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

NEW Starrett MICROMETER

measures where other mikes won't

After 75 years of pioneering in the field of precision measuring, Starrett is still coming up with ingenious new ways to speed and simplify measuring.

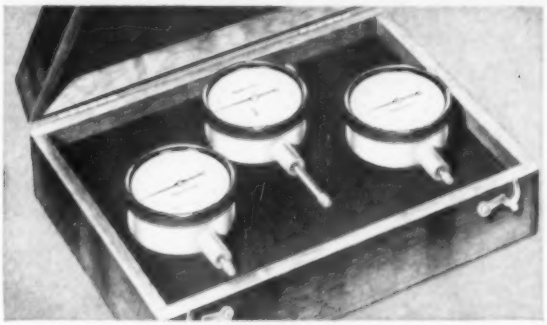
Take the new No. 220 Series MUL-T-ANVIL Micrometer (available in 0-1″ and 1-2″ sizes). A brand new development in micrometer design, it features interchangeable anvils which handle a wide variety of measurements impossible to obtain with standard micrometers. It can also be used with special anvils or converted into a handy height gage.

Superior design, perfection of detail and finish plus accuracy beyond question are qualities that you have always associated with the name STARRETT. You get the same full measure of performance and reliability when you specify STARRETT dial indicators, steel tapes, hacksaws, hole saws, band saws, band knives and precision ground die and flat stock.

Stocked and sold by your *INDUSTRIAL SUPPLY DISTRIBUTOR* . . . always a convenient, dependable and economical source of supply.

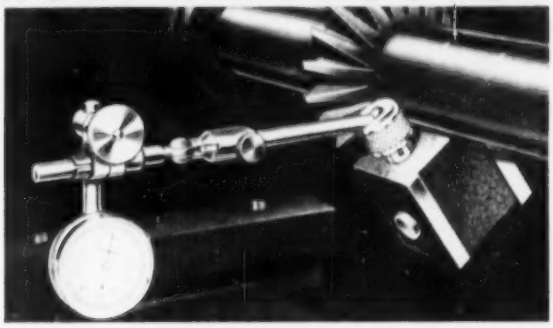
WHEN YOU MEAN PRECISION YOU SAY STARRETT

OTHER NEW STARRETT PRODUCTS



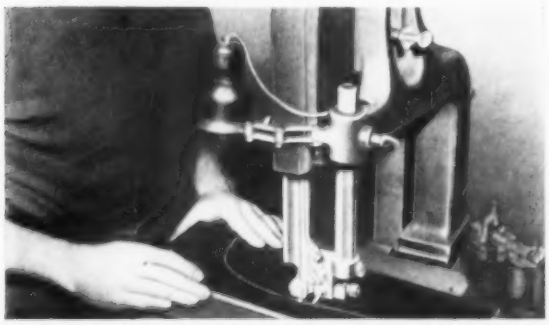
NEW DIAL INDICATOR SET

Set No. 253 fills most indicator needs for small shops or big shop departments. Three indicators in handy mahogany case are graduated .001", .0005" and .0001"; ranges .025", .125" and 1.000".



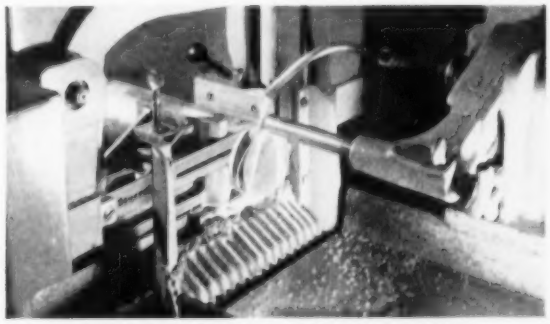
NEW MAGNETIC BASE INDICATOR HOLDER

No. 657 has off-on push button for one-hand setup plus universal adjustment and other exclusive features. Uses any Starrett "Last Word," No. 196 or No. 25 Series dial indicator.



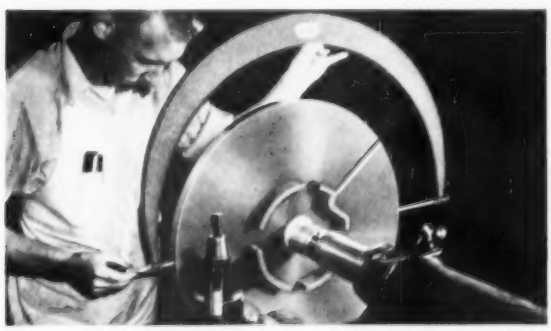
DIE AND FLAT STOCK — NOW OVER 1000 SIZES

Precision ground to Starrett standards of accuracy. Available in oil, water, oil and water or air hardening types. A great time and money saver. "Just lay it out . . . and saw it out" to save valuable man and machine hours.



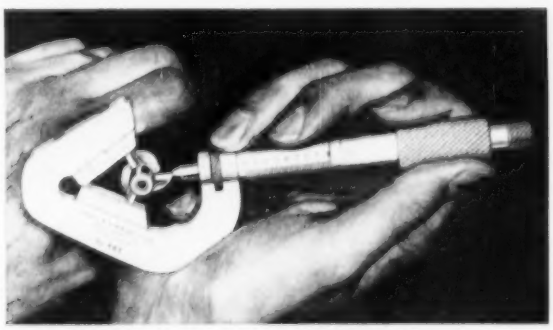
NEW "COLOR-IDENTIFIED" HACKSAWS

New Starrett Hacksaws are color-identified for quick selection and production-proved to give you the performance you need for any cutting job. Starrett also makes band saws, band knives and hole saws . . . uniform quality from one dependable source.



TUBULAR MIKES FOR BIG WORK

Sizes range up to 168 inches. Bow or bar types with fixed, sliding or interchangeable anvils — also dial indicator heads or special contacts. Light yet rigid for perfect balance, sensitive feel and easy handling.



NEW ODD FLUTE MICROMETERS

No. 483 and No. 485 measure 3 and 5-fluted cutting tools, eliminate special fixtures. Read direct in thousandths. No glare Satin Chrome Finish with long-wearing carbide facings on anvil and spindle.

BIG NEW CATALOG NO. 27

Describes and illustrates the complete Starrett line.
Ask your Industrial Supply Distributor or write for free copy.
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Buy through your INDUSTRIAL DISTRIBUTOR — Prompt delivery, dependable service, quality products

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WORLD'S GREATEST TOOLMAKERS

THE L. S. STARRETT COMPANY
ATHOL, MASSACHUSETTS, U. S. A.

now...

VALUABLE DIE-SET DATA FOR ALL TOOL ENGINEERS

It's easy-to-look-at! More than 200 pages are specially edited and arranged for quick and simple reference. Full color is used to make tables easier to read, illustrations more clear. The easy-to-look-at format plainly indicates all optional features. Covering the complete Danly "Leadership Line", this catalog presents full dimensional data and specifications for all Danly Die-Sets, Diemakers' Supplies, Bolster Plates and Bolster Plate Accessories. Get your copy of this new easy-to-look-at Danly catalog. *Write for it today.*

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DIE SETS AND DIEMAKERS' SUPPLIES

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2100 South Laramie Ave., Dept. A, Chicago 50, Ill.

Spot news...

- **Russia wants big boring mills, jig borers and milling machines** from Britain. Bulganin and Khrushchev revealed at London. British Board of Trade circulated the list of Soviet requirements to British manufacturers, showing which of the machines can be exported (most of them are on the embargo list).

- **Military production of synthetic sapphire jewel bearings** has been begun by Elgin National Watch Co under special contract with Frankford arsenal. Project centers around 26 automatic and semi-automatic machines developed by Elgin during past six years.

- **Auto companies are letting it slip that '57 models are going to cost more** — purposely, it's said around Detroit, to boost lagging '56 model sales.

You can now study machine tools, presses and mechanisms in action — by means of a new hold-it-in-your hand camera that takes high-quality 16-mm pix at up to 5000 frames per sec. Camera holds up to 200 ft of film, enough to record erratic behavior in several continuous machine cycles in many instances.

- **Vacuum casting of high-quality large forging ingots** will start shortly on an experimental basis at U S Steel's Duquesne Works. Object of the new process is to reduce trapped gases in the steel, thus eliminate defects.

- **Orders placed at the Hanover (West German) Fair will beef up Red China's** Second Five Year Plan. Delegations placed firm orders for tractors, diesels and electric machinery and ships — were promptly followed by Russian teams who discussed details with individual German manufacturers.

- **Heavy presses will save $13 million in producing just one type of jet fighter** by forging one-piece aircraft components instead of the old method of machining from solid slabs, an Air Force spokesmen says.

U S industry is spending 65¢ out of every dollar on paperwork, the Records Management Institute claims. Suggested ways for a 100-employee firm to cut down: have 62 file drawers of records or less, keep only 29 in the office, store the less-active balance for less than $27.50 a year, limit vital company records to one drawer, and protect them (microfilm copies, etc) for less than ½¢ per paper.

- **Japanese firm will set up a $5-million toy and bicycle plant in Venezuela.** Masaji Ltd will spend $1.5 million on machinery and equipment, is bringing in Japanese technicians to set up the plant.

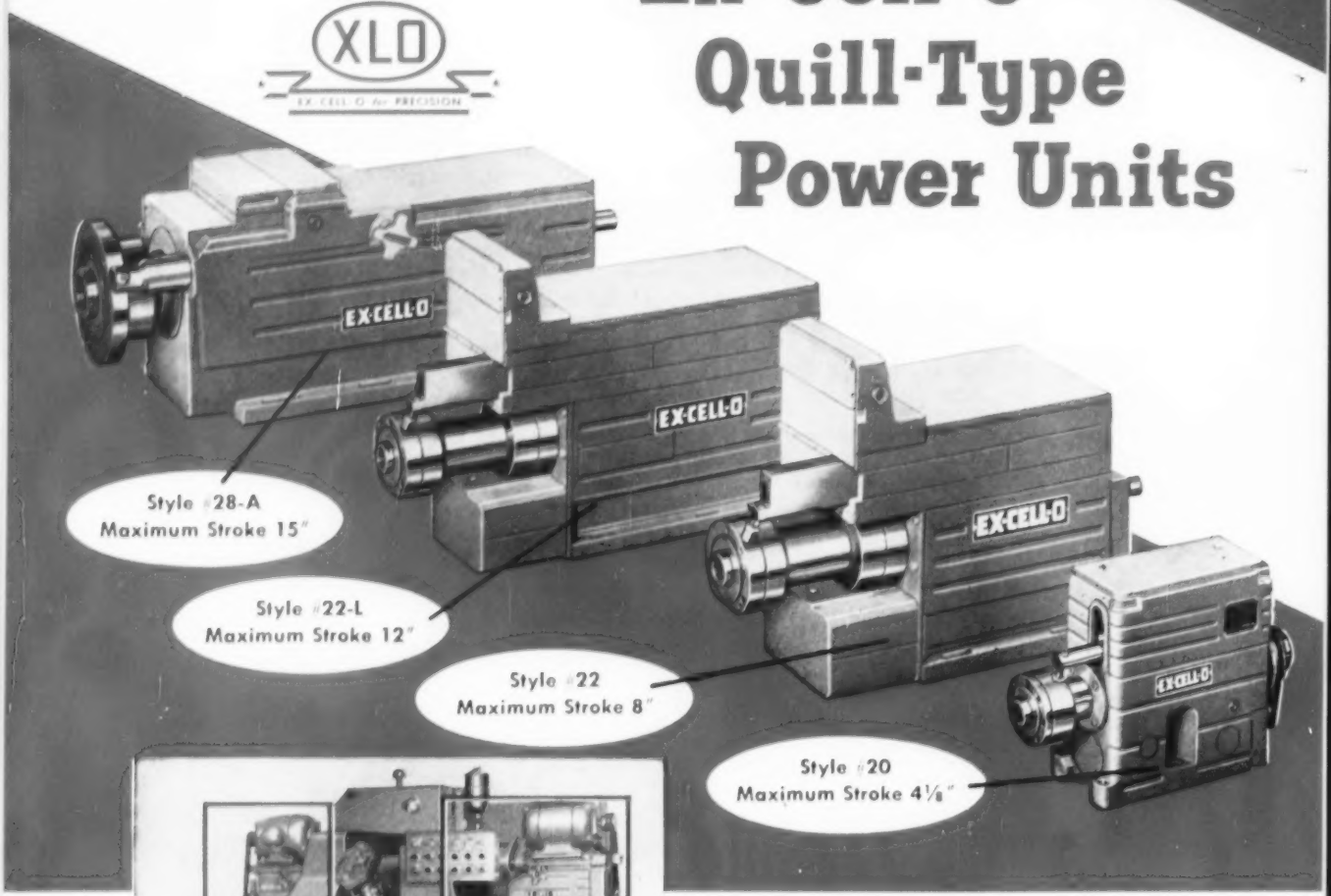
- **Today's jet fighters are reversing proportions of hard vs light metals** in aircraft. New fighter models require 70-75% steel, as against a previous 15-20%, according to Air Materiel Command's Maj Gen David Baker.

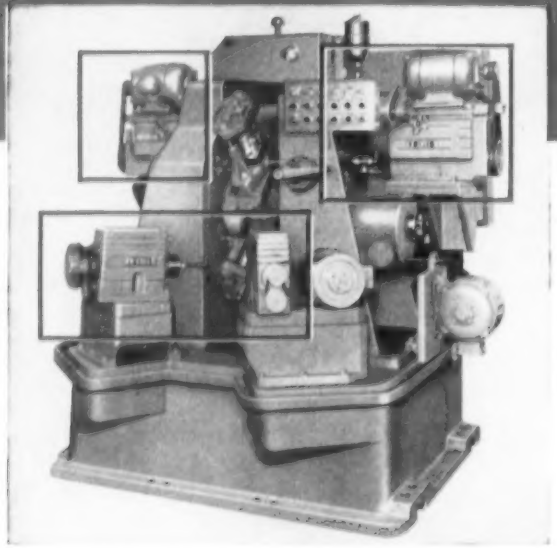
- **Heavy-duty lathes will be produced for the first time in Red China,** in a plant being built at Wuhan.

- **Surplus machine tools would be shipped to backward countries** such as South Korea if an Air Force plan can be worked out. Old machines of simple design for day-to-day use in small shops would go "for free." No European nations are in the plan, because political repercussions from "dumping" machine tools would be too great.

FOR AUTOMATIC CYCLES IN PRODUCTION MACHINES:

Ex-Cell-O Quill-Type Power Units





This special machine with automatic indexing fixture core-drills piston pin holes and drills angular oil holes. It uses six Ex-Cell-O Power Units (shown without belt guards) operated from a central push-button station.

Ex-Cell-O Hydraulic Power Units feed and rotate cutting tools in easily controlled automatic cycles. They actuate single tools or multiple spindle heads for such operations as drilling, reaming, counterboring and spot-facing. Hydraulic operation provides smooth, powerful movements.

Styles 20 and 22 Power Units can be supplied for step drilling, by means of which small, deep holes are drilled automatically in successive steps.

For complete information, including specifications and installation drawings, ask your Ex-Cell-O Representative or write Ex-Cell-O in Detroit.

EX-CELL-O CORPORATION DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

55-13

Washington ... NEWS REPORT

New interest in steel prices . . .

Washington investigators are getting interested in all the talk from the steel industry about a forthcoming increase in prices.

The time is approaching for the steel industry's wage negotiations (see page 166), which are usually the background for industry predictions that higher wages automatically mean higher prices.

But there is a switch on this theme this time around: now industry leaders are saying that the companies need the higher prices to bring in enough money to finance the heavy capital expenditures they must begin making in order to have the capacity on hand to meet future demand.

The relationship between prices, wages, and profits has been under study for several weeks by the staff of the Congressional Joint Economic Committee. When this report is out, the Committee—headed by Senator Douglas (D.Ill)—will decide whether hearings will be held.

Nickel gets action . . .

Small users of nickel are getting government help in answer to their complaints about "gray market" in the scarce metal.

Congressmen from industrial cities have been stirred up over reports from constituents that they have to pay $2.50 to $3.00 per lb for 64.5¢-per-lb metal.

Figures show that consumption is now equal to the production rate of 300 million lbs per year. One possible outcome is that the Office of Defense Mobilization may hand out tax amortization benefits to get an increase in nickel production of 100- to 150-million lbs per year.

Arthur S Flemming, ODM chief, has ordered a new market study to find out what's going on; he calls nickel "one of our toughest problems."

New tax regulations still to come . . .

The new tax law Congress passed back in 1954 was one of the most far-reaching for businessmen—and particularly the metalworking industry. It was an overhaul of the whole tax code that included provisions giving companies more leeway in taking faster tax amortization on their equipment.

But two years later, Treasury's Internal Revenue Service is still having trouble turning out the regulations that are needed to interpret much of the law for the taxpayer.

The regulations covering fast tax writeoffs, for instance, are still not final. It took IRS staffers a year to turn out their first version—which was promptly tossed back for a rewriting. The purpose: to make the regulations as completely understandable as possible, in view of the wide variety of interpretations possible from a law that's worded to cover a general situation.

The proposed regulation is being revised now on the basis of suggestions made at public hearings.

The final regulation is being pushed, but it will still be sometime before it's out.

Some of the new regulations are already out: the one on the tax treatment of partnerships has been widely praised. One tax service called it a "startling departure from the stilted, diffuse, and obfuscatory style of traditional Treasury regulations."

Court rules on "show the books" . . .

If you plead inability to pay increased wages, you may have to support your position with figures from company books or be found guilty of failing to bargain in good faith with your union.

That's what the Supreme Court has ruled in a case appealed to the court by the National Labor Relations Board.

But in deciding the case—involving Truitt Mfg Co, Greensboro, NC, and the Bridge, Structural, and Ornamental Workers—the Court says it does not mean that employees are automatically entitled to "substantiating evidence" in every case where economic inability to pay is raised as an argument against a demand for increased wages.

The only general rule that's left, it is clear from Justice Black's majority opinion, is this: NLRB must decide in each case, after looking at all the facts and circumstances, whether the company is meeting the Taft-Hartley obligation to bargain with the union in good faith.

New government loan program . . .

The Small Business Administration has opened up a new program of loans based on "character"—much as private lenders turn out small loans to employed people. If a man's character is good, and he says he needs the money, then he's figured as being generally a good risk.

SBA lends up to $15,000, with a local bank putting up 25% and assuming the responsibility for investigating the borrower's credit rating and assuming the collection of the payments.

Manufacturers—small ones, obviously—are getting the largest percentage of the loans, money-wise, although wholesalers, retailers, and service trades are getting the largest share of the loans numerically.

BAY STATE TAPS

PRECISION PERFORMANCE

of Bay State Taps means precision threads on a production basis. Made in all standard and special sizes, these taps are available from your nearby industrial supply distributor. Gain precision performance on every tapping job with controlled contour taps . . . made by BAY STATE TAP & DIE CO., MANSFIELD, MASSACHUSETTS.

Detroit ... NEWS REPORT

Between AMC's lines . . .

American Motors' recently issued "Progress Report" made its position pretty plain—but it also left some reading to be done between the lines.

AMC's volatile president George Romney listed seven reasons why the Nash-Hudson merger is going to succeed where Studebaker-Packard is failing.

They spell out AMC's hope for a continued climb to a secure place in the industry sun:

(1) AMC is a larger and more diversified merger than any in the automotive business.

(2) AMC's non-auto activities have been making a steady profit since 1929, except only for 1946.

(3) AMC has made steady progress since its merger in reducing the loss level that both its components experienced on their own.

(4) AMC's approach to the auto business is far different from Studebaker-Packard's—at the time of its merger, AMC decided not to try to compete with the Big Three, rather to concentrate on holding down tooling and manufacturing expenses.

(5) AMC says its break-even point is "substantially below the 200,000 unit mark—and, Romney points out, last year, five of the Big Three cars sold less than 200,000 units (Dodge, Chrysler, Cadillac, DeSoto and Lincoln). Although AMC refuses to disclose just what its break-even point is, it can be deduced this way: anticipated output of 150,000 Ramblers won't be reached this year. Production, now running about 33% ahead of 1955, indicates 120,000 output for this year. Ramblers constitute 70% of AMC production, so you can figure total AMC auto output at about 170,000 units.

(6) AMC says it doesn't require a "large financing program for future cars or programs."

(7) AMC says the bulk of its tooling spending for the next several years is already accomplished.

Unorthodox course . . .

AMC is pursuing a rather odd course, as can be seen on closer inspection of Points 5 and 7 above. AMC is maintaining three divisions, yet one of them does 70% of its gross business.

Detroit observers wonder how long this can go on in its present form: in other words, whether AMC will shrink its lines.

In answer to questions, President Romney said "the bulk of our tooling expenditures are behind us for several years." Asked if AMC would have 1957 model changes, he said yes, but the changes won't be big.

AMC's tooling expenditures will be low, admittedly, for the next several years on the Hudson-Nash lines. Body-wise, spending will be near to rock bottom on AMC's big cars. Engine-wise, the company has a new engine with a horsepower than can be jumped from 190 to 300 without major machining or tooling changes.

But there's little danger of the company getting into dangerous financial waters. From here, it looks like AMC will long continue its Nash-Hudson in their present form without more encouragement from the buying public.

Romney's gospel, that the American public needs, wants, and will buy his version of a "small car with big car characteristics" seems to be borne out by the Rambler's popularity.

A solid line of Ramblers, big and small, coupled with AMC's prosperous appliance business (the Kelvinator line) could be a potent money-maker, and a safe bet for the future.

Heard and seen around Detroit . . .

Ford will start installing new machinery for manufacture of steering gears at its new Indianapolis plant in January—for '58 model runs.

Although no major styling changes are slated for the 1957 Continental Mark II, there'll be certain running changes made in the current model for the upcoming '57's.

Rocking under the impact of lessened sales, auto people are pretty gloomy these days. Says one marketing specialist, "If business doesn't pick up—and quickly—a disastrous third quarter could rock the nation's economy."

Here's how production figures stacked up for the first week in May: GM down 12.7%, with Chevvy leading the way with a whopping more-than-20% slash . . . Ford is down an overall 5.8% . . . Chrysler is off 9.8% . . . Studebaker-Packard down 6.27% . . . AMC off 11.8%. Overall, the auto industry for the first four months of 1956 is down to 2,291,093 units from 2,879,140 units in comparable 1955 — a 20.4% drop.

Trucks look a little better. Among the big automakers, only Chevrolet output slowed down in the first week in May from the last week in April. Chevvy scheduled 11.1% less output. Ford was up slightly—0.66%; GM registered a 1.4% rise; Studebaker rose 2.5%; and Dodge showed 1% more production.

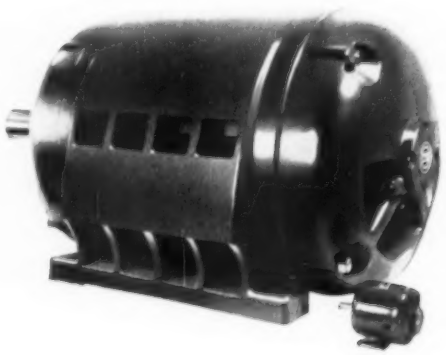
Overall, the truck industry, counting in all the manufacturers, did 4.9% better in the first four months of 1956 than it did in 1955.

You Name It—Thousands of Ratings

From 1/8 to 400 H. P.

See **MASTER** for a selection of motor drives that you can get nowhere else—for specialized power drives unequalled for flexibility, compactness and performance. See Master for the right horsepower, right shaft speed, right mounting features—to add salability to your products, efficiency to your plant equipment.

Master components are designed to combine in one compact unit to suit your needs exactly—all the way up to 400 H. P. Just ask us for information.



Motor Ratings	⅛ to 400 H.P. All phases, voltages, and frequencies.
Motor Types	Squirrel cage, slip ring, synchronous, repulsion-start induction, capacitor, direct current.
Construction	Open, enclosed, splash-proof, fan-cooled, explosion-proof, special purpose.
Speeds	Single-speed, multi-speed, and variable speed.
Installation	Horizontal or vertical, with or without flanges and other features.
Power Drive Features	Electric brakes (2 types)—5 types of gear reduction up to 432 to 1 ratio. Mechanical and electronic variable speed units—fluid drives—every type of mounting.

THE MASTER ELECTRIC COMPANY
Dayton 1, Ohio

MASTER ELECTRIC MOTORS

Machine tools ... NEWS REPORT

Air Force develops formula . . .

The Air Force, committed to a machine tool replacement and modernization program, has in the making a replacement formula which enables one to put down on a single sheet the pluses and minuses of buying a new machine in terms of costs and of savings. It resembles the MAPI formula.

The formula is to be used in carrying out the Air Force machine tool plan outlined by Assistant Secretary Dudley Sharp to the NMTBA members at Houston in March. Mr Sharp said then that about $70 million had been authorized to carry out the plan the first year.

Whether Air Force replacement buying will be done at Wright Field by Air Materiel Command or by contractors has not been decided. AMC has the final decision and it probably will handle the ordering itself because it feels that it can get better prices than its contractors.

Plane makers won't spend money . . .

While Air Force officials would love for the aircraft industry to spend its own money freely for new machine tools to replace older equipment, they privately hold little hope that anything much will come of it.

Feeling is that as long as the Air Force will even remotely consider financing purchases of new machines, the aircraft people will not spend their own money.

Air Force is in process of declaring surplus at least 5000 machine tools that it no longer can use. The final number may be much larger than that.

It will be the biggest assemblage of machine tools to be put on the market since the days of War Assets following World War II.

However, these machines may never get onto the market if one plan is adopted: To send those machines that have some day-to-day use to backward countries for free — like South Korea.

Services own 400,000 tools . . .

Holdings of machine tools by the armed services have never gone above 400,000 units. The figure of 500,000 units, worth $6 billion, was a gross exaggeration.

The 400,000 figure was arrived at by an actual count of 279,000 machines and adding onto that amount an estimate of the unclassified machine tools held by the services.

Defense Department is about to solicit the aid of machine tool people in appraising the value of a large number of machine tools held in storage here and there.

A new Directory of Metalworking Machinery should be ready for publication by year's end.

It will contain around 72,000 items, a notable increase over the 60,000 items in the 1951 edition compiled by the old Munitions Board.

60-65 builders to get pool orders . . .

Some 60 to 65 machine tool builders are to share in the pool orders placed by General Services Administration under BDSA's M-Day trigger program. Total orders will run to $256 million.

Office of Defense Mobilization plans to tell machine tool people that no additional funds will be marked for this program unless a national emergency should occur. It has been expected that the industry would push for an increase. The upcoming contracts cover only requirements for the first six months following M-Day.

$18 million of the $21 million granted to GSA as backing for the pool-order program is to be set aside for contractors' working capital advances (if and when necessary). The remaining $3 million is estimated as the "probable ultimate net cost" of the program to the government — based on experience in the Korean crisis.

$50 million for turbine gears . . .

The off-again-on-again turbine and turbine-gear reserve machine tool program has unexpectedly been given a nod of approval by the Budget Bureau and is reported ready to roll. It previously had cleared all other hurdles.

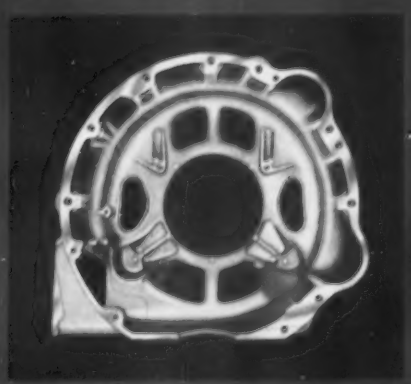
Only stipulation, and an important one, by Budget Bureau is that the program be cut down from the proposed $70 million to $50 million.

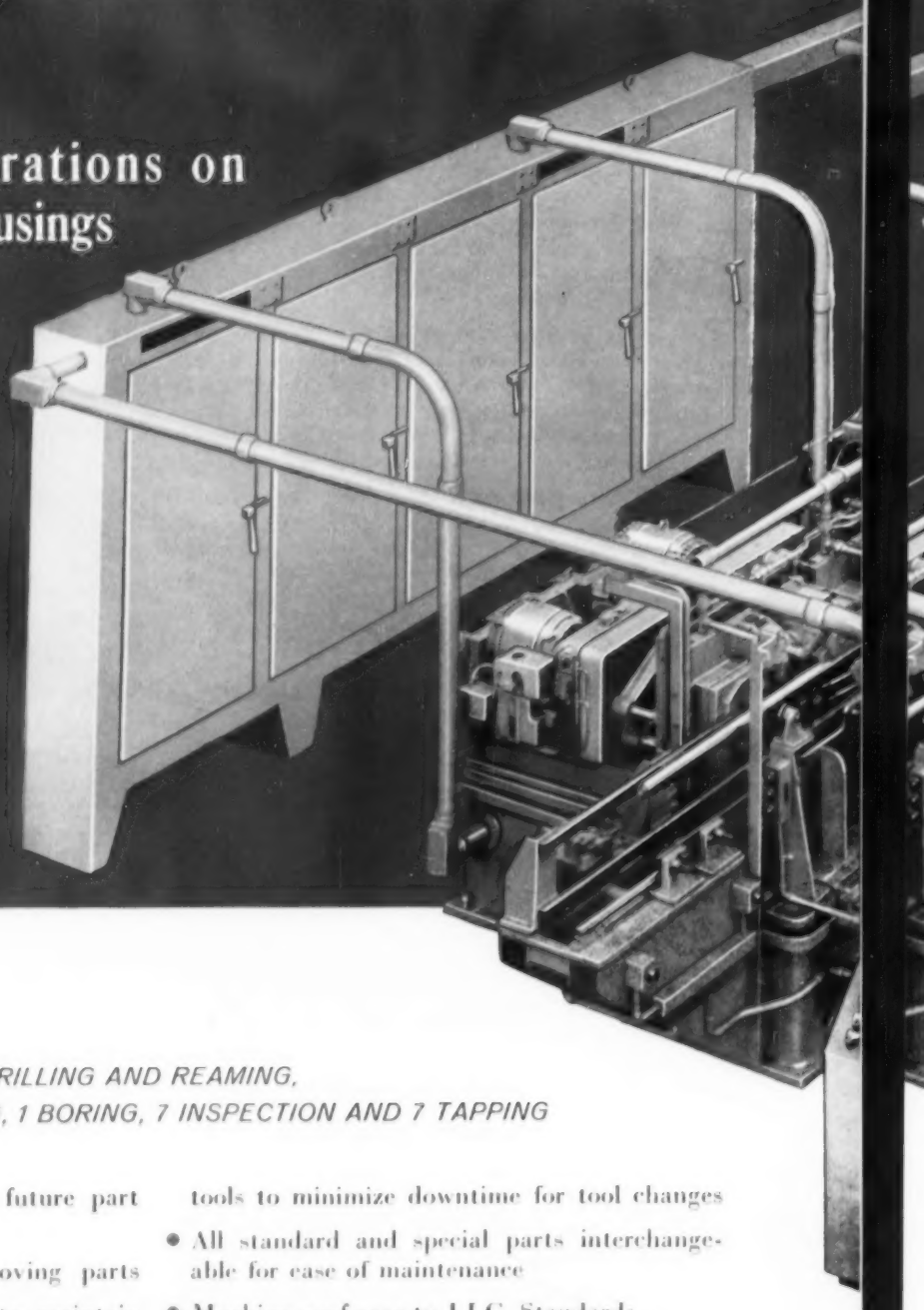
Alfred Herbert Ltd is erecting a factory near Coventry, England, to make DeVlieg jig boring and milling machines under a licensing arrangement with the DeVlieg Machine Tool Co.

Kochring Co, Milwaukee, maker of construction machinery, is to acquire the Hydraulic Press Mfg Co, Mount Gilead, Ohio, if an agreement recommended by the boards of directors of both companies is ratified by stockholders.

Buhr ECONOMATIC

performs 62 operations on torque converter housings





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- Sectionalized bases to facilitate future part changes
- Automatic lubrication of all moving parts
- Mist-lubrication to all spindles to maintain uniform temperature in heads
- All spindles arranged for pre-setting of cutting tools to minimize downtime for tool changes
- All standard and special parts interchangeable for ease of maintenance
- Machine conforms to J.I.C. Standards
- Hardened-and-ground automatically-lubricated steel ways.

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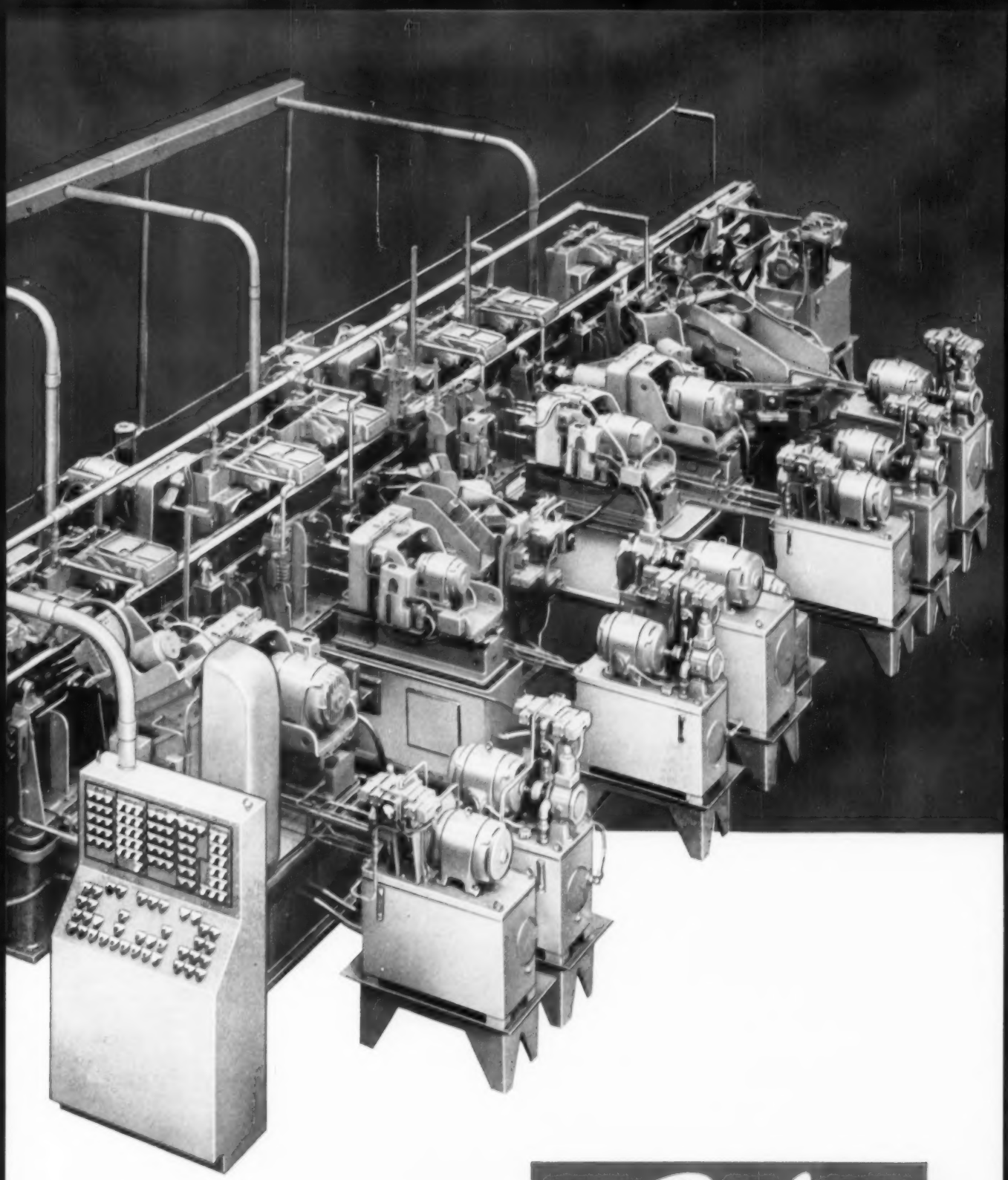
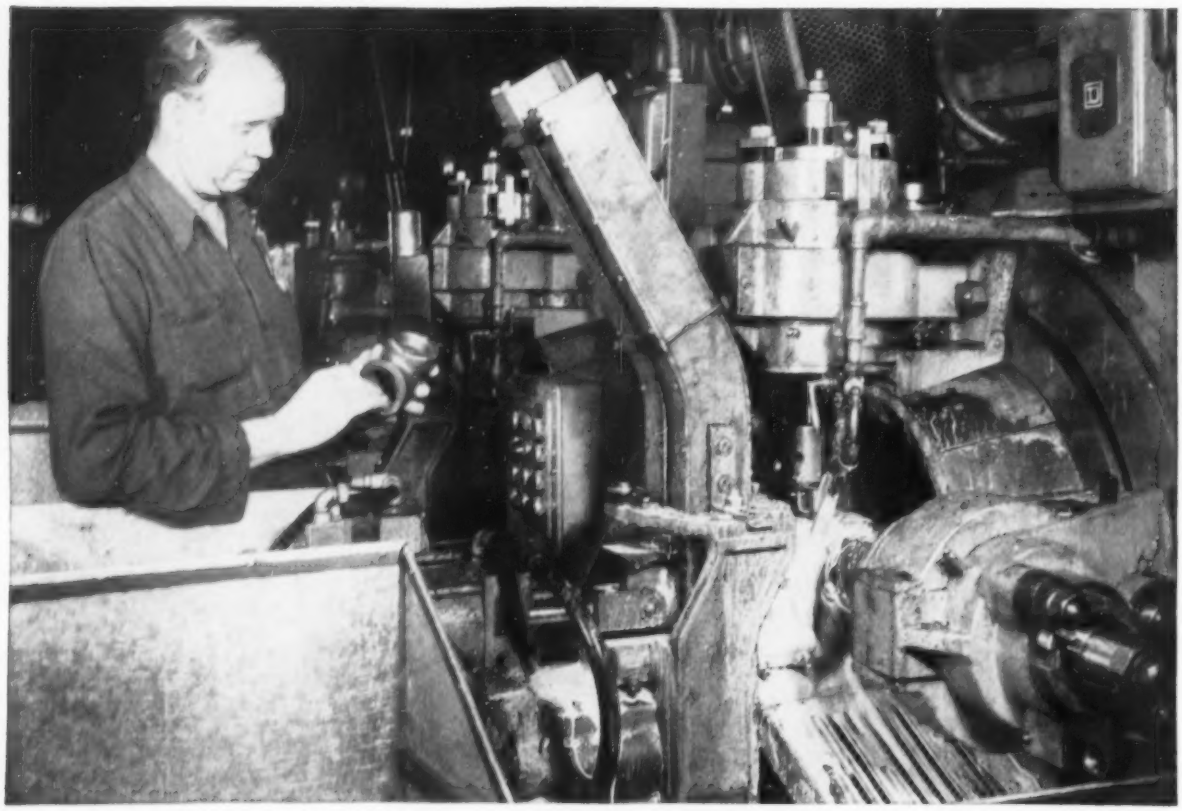


Buhr

MULTIPLE-SPINDLE
HIGH PRODUCTION MACHINERY



Detroit Brass & Malleable Co. is one of the largest manufacturers of plumbing and drainage fittings in the Midwest. Over 3 million fittings are turned out each month on these automatic tappers. A 10:1 emulsion of *Texaco Soluble Oil C* is used exclusively as the cutting fluid.

"We proved it pays to use Texaco"— says Mr. Robert Welch, General Foreman, Detroit Brass & Malleable Co., Wyandotte, Michigan

THIS PLANT had been using *Texaco Soluble Oil C* in its automatic tapping machines for 15 years. Results were excellent. But how about economy?

To answer this important question, Texaco was tested against 14 other brands. On the basis of test runs, machines were changed over to a less expensive oil that *seemed* equal in quality to Texaco.

"After 30 days with the new oil," reports Mr. Welch, "tool life was shorter than it had been with Texaco, and rusting was a serious problem. We went right back to Texaco, and are again getting longer tool life, better finish without a trace of rust, and more profitable production."

This typical experience points out one important fact: whatever the stock, however you machine it—there is a complete line of Texaco Cutting, Grinding and Soluble Oils to help you get the job done better, faster and at lower cost.

A Texaco Lubrication Engineer can help you bring these benefits to *your* plant. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, New York.

TEXACO **TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS**

TUNE IN . . . TEXACO STAR THEATER starring JIMMY DURANTE on television . . . Saturday nights, NBC.

What's ahead ... in Metalworking

NEWS REPORT

Capital goods demand to brake slideoff ...

Metalworking production is staying on a remarkably high plateau, especially in view of the severe drop in automobile making.

There has been a slight easing of operations month by month this year, a downward movement that is expected to continue. However, no serious dip is anticipated.

It is getting to be an old story to say that the demand for capital goods is almost solely responsible for Metalworking's fine showing this year. Yet it is a story that is worth repetition.

There is scarcely an industry that makes hard goods or builds machinery that is not pretty well loaded with work far ahead. Farm equipment is a notable exception.

Take the steel rolling mill people. They have been swamped with orders. One company, typical of all, has tripled its backlog in a matter of months and new business still is pouring in.

Business is so good, in fact, that the rolling mill manufacturers are looking for additional capacity to help whittle down their huge pile-up or orders. And steel mills are not anywhere near through placing orders.

Construction machinery sales have been moving up rather than down. Volume this year has increased as much as 40% for some firms.

Power plant equipment is turning in a good performance, with factories booked solidly for the next 2 years or longer.

Freight car builders have the most business in years. Backlogs are as much as five times those of a year ago. Production will be stepped up as the year goes along.

Machine tools, tools and dies and related products are in an expanding market.

How much steel is being stored? ...

The enigma in steel is simply this: How much tonnage is being put away by users against either a steel strike or a price hike or both? It is a certainty that a considerable amount of steel now being delivered is not being used.

There will be no definitive answer until the steel industry has a new wage agreement.

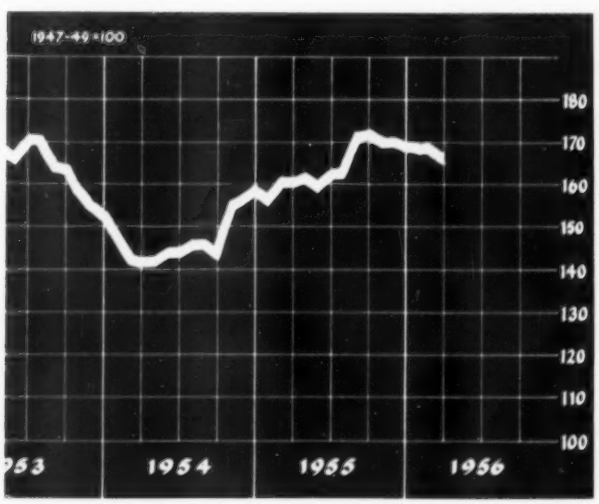
Industrial equipment and supply orders have set a new peacetime record. The index of the American Supply & Machinery Manufacturers' Association is at 206.7, more than double the base month in 1948.

Shipments of screw machine products have risen to the highest level since 1953. New orders are increasing in volume too.

Plane production to stay high ...

Aircraft production will be one of the stabilizers in Metalworking this year. Plane backlogs are lengthening and operations should be steady all year. Military-plane output in particular will be up to the 1955 total, which was very good.

Many aviation parts makers are looking for a pickup in business by fall. They then hope to get back up to where they were in late 1954 and early 1955. Some are now retooling.



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

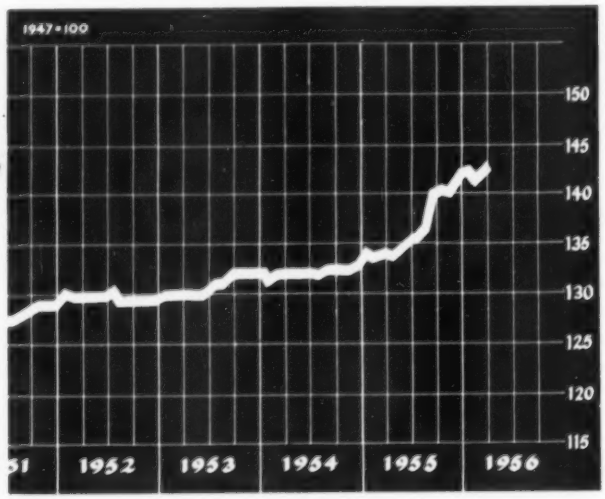
	APR Estimated	MAR Preliminary	FEB Revised	MAR Year Ago
Total Index	166	167	168	157
Machinery	146	148	126	
Electrical Machinery	192	192	185	
Autos	134	139	157	
Other Transportation	307	310	264	
Other Metalworking	139	139	131	

NEWS REPORT

What's ahead . . . in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	APR Estimated	MAR Preliminary	FEB Revised	MAR Year Ago
Total Index	**142.7**	**142.5**	**141.9**	**134.2**
Metalworking Machinery		**161.9**	**161.5**	**146.2**
Other Machinery exc. Electrical		**148.6**	**148.3**	**138.9**
Electrical Machinery		**137.6**	**137.6**	**131.6**
Fabricated Metal Products		**137.5**	**136.5**	**130.5**



Business drifts downward a bit from peak . . .

Business in general is having trouble holding its own. It still is rolling along at a pace somewhat above last year's. But it is showing a tendency to lose a bit of momentum.

It would not be surprising if volume slipped a little as the second quarter progresses.

And it is well within reason to expect perhaps more than a seasonal slide this summer.

This is not to say that business is headed into a recession. There is too much strength in the situation as a whole to give credence to such an assertion.

Keep an eye on trouble spots . . .

Conditions, nevertheless, bear close watching. There are trouble spots here and there; and one should keep an eye out to see whether they spread.

It is the capital goods industries that lend strength to business at this point. Without such vital support on their part, things would definitely be off.

While consumers have the desire to buy, and all polls show that they expect to make large purchases of all sorts of goods this year, the credit situation has much to do with what will happen from here on.

More credit is being used, per dollar of goods bought, this year than last. This means that installment-credit total has soared to a new high. It has not risen at last year's rate. But the fact is that it still is going up.

Remarkably little unemployment exists on a national scale. There are a few "pockets" like Detroit where it has worsened because of the contra-seasonal trend in auto production. But these continue to be the exception rather than the rule.

Prices of industrial products are still inching up month by month.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49 = 100)*	147.4	148.5	142.1
Steel ingot production (thousand tons)	2,375	2,373	2,345
Electric power output (million Kilowatt hours)	10,815	10,867	9,586
Production of automobiles and trucks	151,366	163,224	215,756
Engineering construction awards (Eng. News-Record, millions)	$557.7	$389.0	$458.7

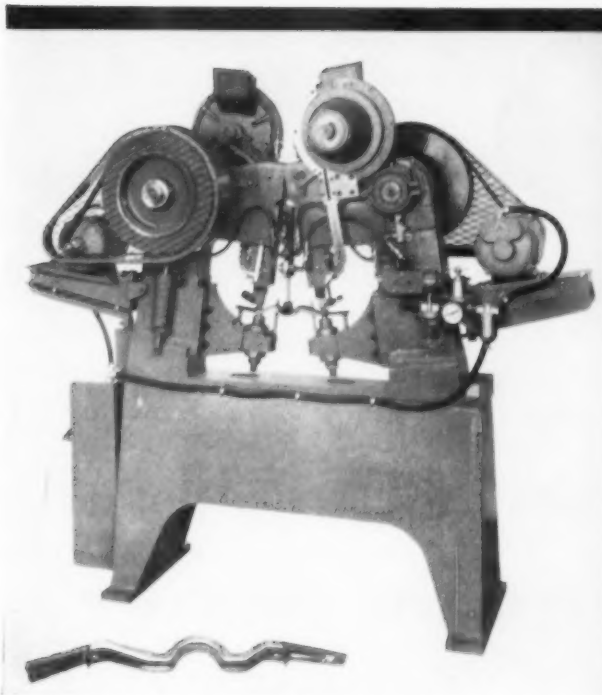
MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	299	292	339
Vacuum cleaners sales (thousands of units)	286	302	263
Washers sales (thousands of units)	406	394	353
Household electric ranges sales (thousands of units)	123	110	127
Radio production (thousands of units)	1,094	1,079	1,090
Television production (thousands of units)	576	588	703
Gear sales index (1947-49 = 100)	256.2	245.5	148.5
Foundry equipment new orders index (shipments, 1947-49 = 100)	169.0	195.6	90.4

*Seasonally adjusted

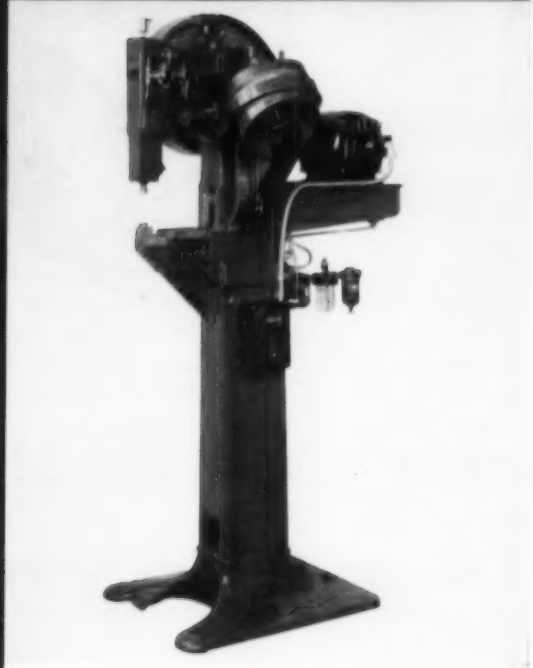
T-J does your riveting and clinching

Faster...Automatically!



This T-J Special Dual Rivitor sets two rivets at a time . . . consists of two 8" throat Model R Rivitors, each with 10" hopper, special oversize anvil post, and special horn. Sample of work shown below machine.

RIVITORS



T-J Clinchors adaptable to a wide range of clinch nut setting problems. Gravity feed model shown here.

CLINCHORS

Automatic feeding and setting with T-J Rivitors and Clinchors help you reduce labor and step up SPEED in a wide range of assembly jobs for aircraft, automotive, farm machinery, stampings of all kinds.

T-J CLINCHORS set clinch nuts with fully automatic operation, controlled by a single foot pedal. Available in Underfeed and Gravity feed models, throat depths 8" to 36".

T-J RIVITORS automatically feed and set solid rivets with high production. Electrically powered Rivitor sets solid steel rivets up to $\frac{3}{8}$" long. Air-powered sets aluminum alloy rivets or steel rivets up to $\frac{3}{4}$" long. Throat depths 8" to 36".

Write for Clinchor bulletin 555; Rivitor bulletins 646 and 555. The Tomkins-Johnson Co., Jackson, Mich.

T-J TOMKINS-JOHNSON
RIVITORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

The next three years

We have been surfeited with glowing reports about our rapidly expanding economy. The faint-hearted pinch themselves and mutter, "Can it really be true?" In the same breath they exclaim, "This whirlwind growth can't keep up . . . . . a 'breather' is inevitable."

What are the faint-hearted going to say when they see the latest poll of spending plans of American industry?

There won't be any breather . . .

in the next few years, the McGraw-Hill Department of Economics finds. Manufacturing companies soon will have half again as much capacity as at the start of the Korean war. This year alone, they are increasing facilities 8%. In the three years 1957-1959 they will add another 18%.

Much of this expansion will be in the metalworking industries or in industries that directly serve Metalworking. The steel industry intends to push up its capacity some 14 million tons. The aluminum people will provide equipment to make 700 million lb more per year than now. This is on top of a notable rise in facilities the past few years.

Automobile makers will "put on the line" 81% more dollars this year than last for new plant and equipment. And, as everyone knows, Detroit has not been a niggardly spender in many years.

The machinery industry will pay out $1 billion . . .

this year, for the first time in any single year, for capital goods. That is some sort of milestone.

You can put your finger on almost any industry that you wish — mining, petroleum, railroads, electric utilities — and you get the same story. Current outlay for plant and equipment is at or near an all-time peak and no diminution appears likely during the years immediately ahead.

Development of new products is one of the significant reasons why today's and tomorrow's outpouring of money for capital goods is so imposing. Almost one-third of the reporting companies say that a goodly portion of 1956 spending will be in connection with new products. Even more striking, 11% of 1959 sales are likely to be in products not made at all in 1955.

The influence of new products will be tremendous in certain industries — instruments, office machinery, construction machinery, aviation. In those fields, new products will contribute more than 20% of total sales by 1959.

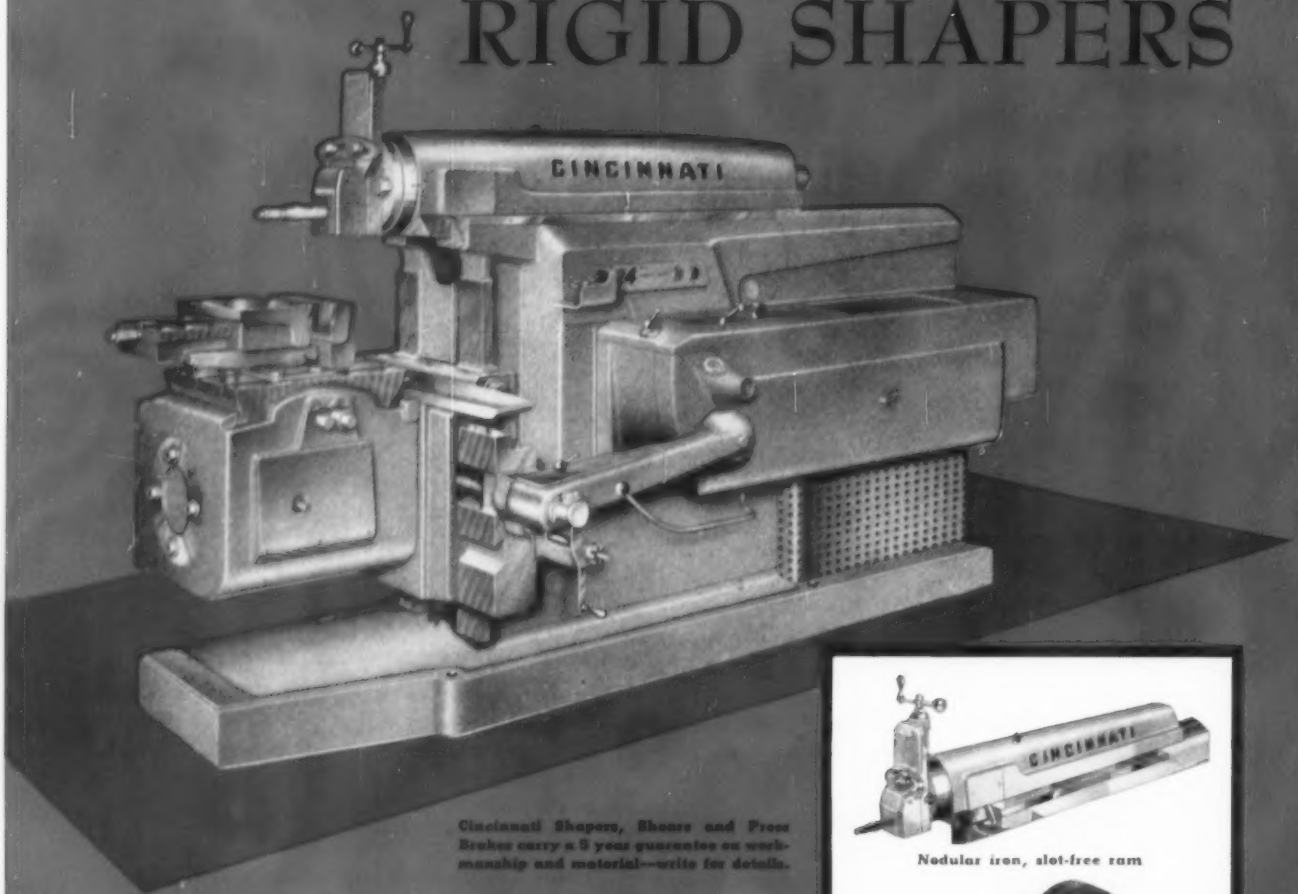
Industry is backing with billions . . .

its belief that today's good times will be with us tomorrow, so far as intelligent forward planning can help insure them. Perhaps most heartening of all, the McGraw-Hill survey confirms the belief that management is thinking farther ahead than it ever did before. It no longer is content to concern itself with this year and let next year and the year after take care of themselves.

More than that, it is adopting the technique used so successfully through the years by the automobile industry. It is bringing into being new products at an accelerated rate and thereby is obsoleting old products and old production methods. What better way to keep the economy vibrant and the demand up?

Burnham Finney EDITOR

CINCINNATI RIGID SHAPERS



Cincinnati Shapers, Shears and Press Brakes carry a 5 year guarantee on workmanship and material—write for details.

New—modern—these Rigid Shapers offer faster, more convenient controls, greater accuracy, greater dependability. The New nodular iron ram, trunnion and vise, and wide, heavily ribbed column give a new rigidity—increase accuracy in cutting.

The New slot-free ram also eliminates the manual clamping of ram adjustment—a time saving feature.

A speedy, dependable electro-magnetic brake and clutch insure a faster performance.

50 P.S.I. pressure lubrication, exclusive on Cincinnati Shapers, is a real insurance against wear and a guarantee of long trouble-free performance.

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The only shaper with 50 P.S.I. lubrication

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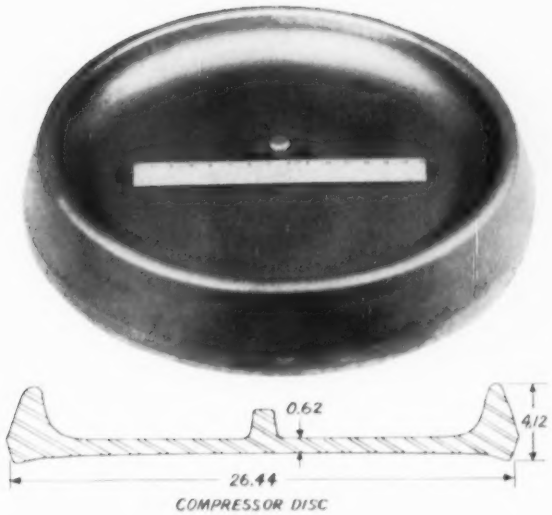
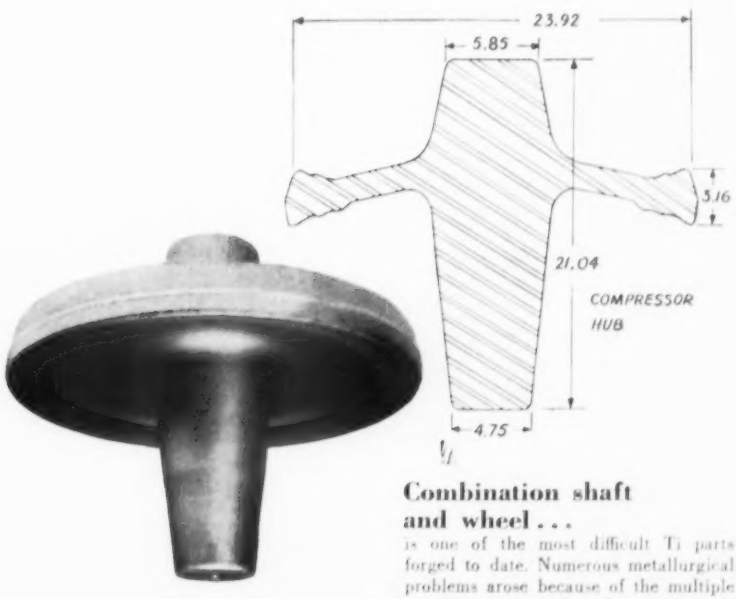


Aircraft compressor wheel . . .
forged from RC-130-B titanium alloy weighs 175 lb. Simple configuration of this part made it relatively easy to forge in the 18,000-ton press. Ti forging operations have been successfully accomplished on both hammers and presses, and both types of equipment are currently being used

Intricate Ti parts now forged in presses

Recent Ti-forging methods in hydraulic presses are opening new avenues for production runs of parts having intricate contours, larger in size and calling for critical specifications on mechanical properties. Up-to-the-minute data on these methods, as well as design recommendation and case studies on current runs of Ti forgings at the Wyman-Gordon North Grafton plant, are compiled here

JOHN P WRIGHT, associate editor
In cooperation with ARNOLD L RUSTAY, director of research, WYMAN-GORDON CO, WORCESTER, MASS DIVISION



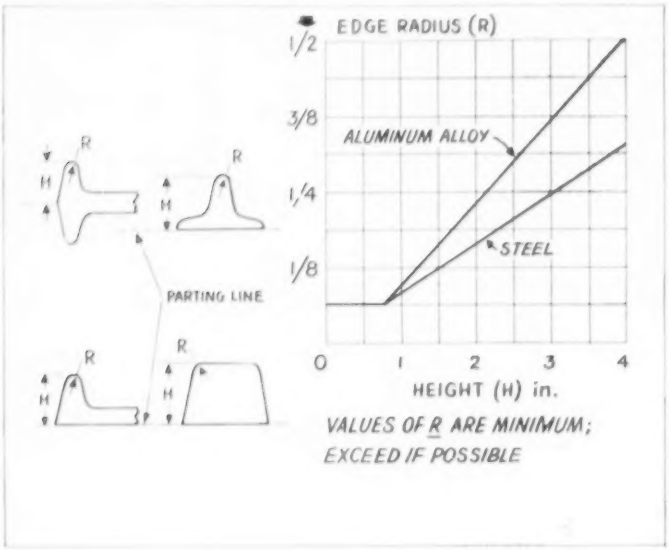
Combination shaft and wheel . . .
is one of the most difficult Ti parts forged to date. Numerous metallurgical problems arose because of the multiple operations required to forge this complicated part

Early stages of forging titanium led to the common belief that it could be forged like stainless steel. However, as the process developed, it was found that Ti had much less shrinkage, that it did not scale the same, and that the forging temperature range was very different from that of stainless and conventional alloy steel. Then just where does Ti fit into the forging picture? Best answer to this question at present is to outline the areas of prime importance where Ti tends to deviate from established forging practice.

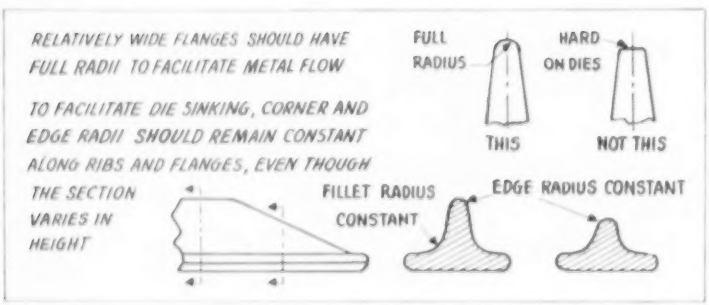
Forged titanium alloys

Compressor wheels have been successfully forged from titanium Ti 140 A, and C130 AM (RC 130 B) with yield strength of 120,000 and 130,000 psi. If higher mechanical properties at elevated tem-

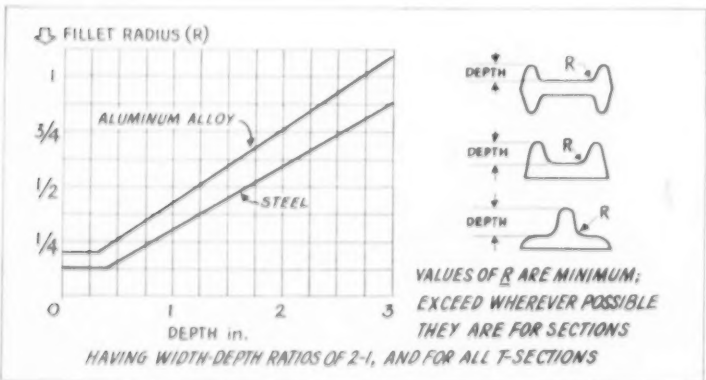
Intricate Ti parts now forged in presses . . .



Design data . . .
for edge radii of steel forgings serves as the best guide for establishing dimensions of Ti radii


RELATIVELY WIDE FLANGES SHOULD HAVE FULL RADII TO FACILITATE METAL FLOW
FULL RADIUS
HARD ON DIES
THIS
NOT THIS
TO FACILITATE DIE SINKING, CORNER AND EDGE RADII SHOULD REMAIN CONSTANT ALONG RIBS AND FLANGES, EVEN THOUGH THE SECTION VARIES IN HEIGHT
FILLET RADIUS CONSTANT
EDGE RADIUS CONSTANT

Recommendations . . .
for wide flanges and advantages of constant corner and edge radii



Fillet radii . . .
dimensions for Ti forgings should approach those dimensions laid down here for steel forgings

peratures of 600 to 800 F are desired, forgings made from Ti 6AL4V (6% Al, 4% vanadium) or C130 AM are used.

Another Ti alloy, 155AX, when forged has the highest yield strength to date of any of the alloys, approaching a yield of 150,000 psi after stress relieving at room temperature. Machining this alloy does, however, present a difficult problem.

As far as the physical properties of finished forgings are concerned, there is no measurable difference between those produced by the impact of a hammer and those produced by the squeeze of a press, assuming, of course, proper procedures and controls in both cases. When forged in hammers, titanium pieces have a tendency to bounce which, of course, is not a problem in presses. On the other hand, when extremely thin sections are attempted, the chilling effect is greater in presses because of continuous die contact, and as a result thinner sections can usually be obtained by use of intermittent blows of a hammer. As in the case of all forgeable materials, therefore, the choice of equipment depends upon a combination of many factors.

Designing part for forging

Consideration must be given to the design of the part itself—that is, contours must be suitable for forging at 1700-1750 F in the final die stage. If adequate mechanical work cannot be done at 1750 F because of shape, lower temperatures must be used to maintain mechanical properties, particularly ductility. When laying out radii, fillets and establishing tolerances, best guide is to approach dimensions laid down for steel-forging practice. However, Ti forgings differ from steel in that they present twice as much of a problem in mechanical work and die closures.

When working titanium to intricate contours and at the same time shooting for absolute tolerances, you run up against the problem of reheating and scaling. In this case it is smarter to minimize the heats and run larger die closures rather than risk falling below specifications on mechanical prop-

erties. Another alternative is to add additional dies providing run of the job will justify extra cost, then dimensions and tolerances can be met. Otherwise the customer will have to stand cost of machining excess material to desired dimensions.

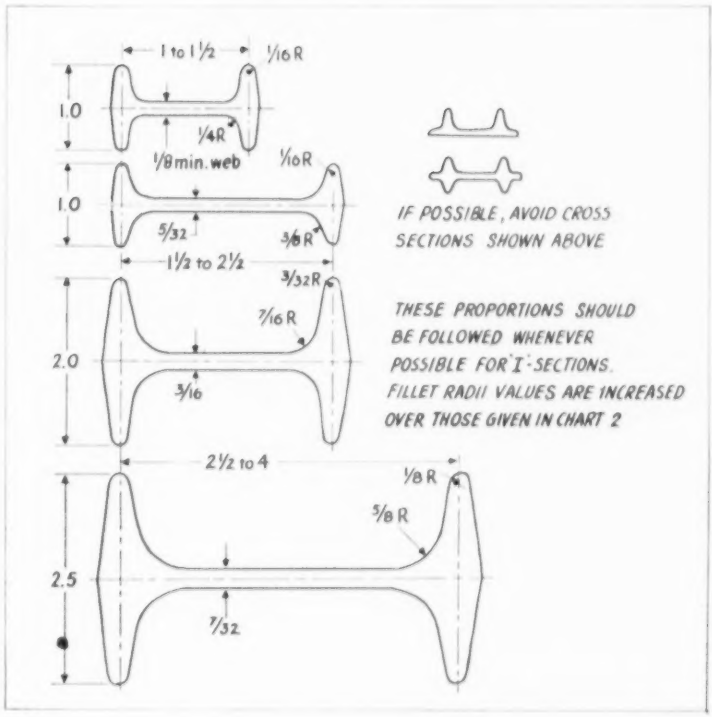
Die design

Design of forging dies should be carefully carried out to avoid waste of titanium and to hold flash to a minimum. Draft on inside plugs can be safely held between 7 and 15° depending on depth of plug. For example a 3-in.-dia plug 3 in. deep or a 4-in.-dia plug 4 in. deep requires 10° draft. Outside draft of 7° is considered adequate for most parts. It is also very important to design dies carefully so they give a maximum amount of mechanical work.

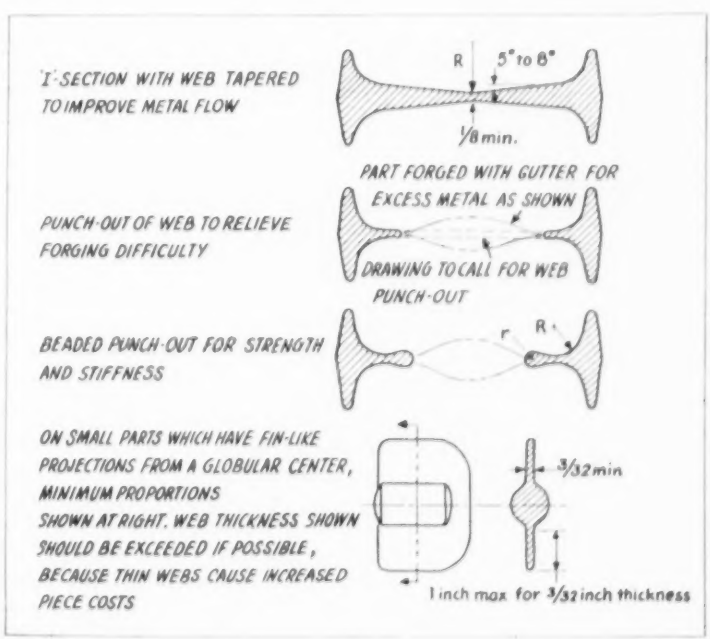
Die life depends upon the type of titanium alloy and how far the material has to be moved. As yet, there has not been enough experience with long-run jobs to state specifically what die life may be expected. However, as an example, on one run of several hundred forgings where considerable metal was moved, a second die-sinking operation on the original dies became necessary. Die life can be increased considerably by using additional dies, thereby cutting down the amount of movement of metal in each individual die.

Forging dies for titanium are today machined and polished to a very high finish only as a precautionary measure, mainly because limited experience on short runs has not indicated how good a finish is actually needed. Press dies give best tool life when machined in an annealed stage and then hardened. Number of dies required for a given job averages one more than those normally needed if the same part is difficult to run in steel or aluminum.

Essentially, the sequence of operations for Ti forgings starts with the bar going through a preliminary die to start initial flow of material and to minimize wear and tear on subsequent dies. Also, the preliminary die gives a better distribution of material.

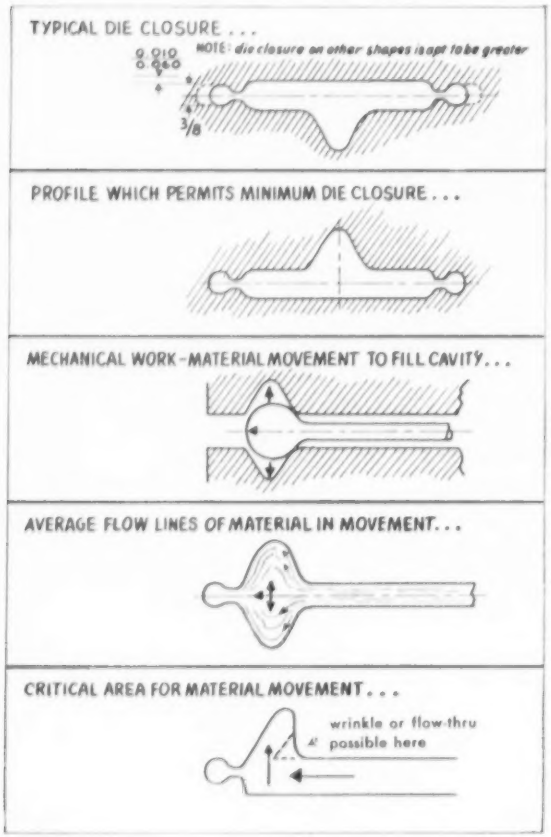


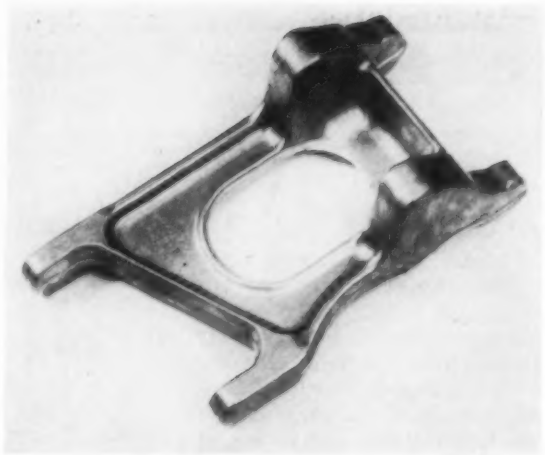
Web-radius . . .
proportions for Ti forgings should follow those proportions shown here for steel forgings

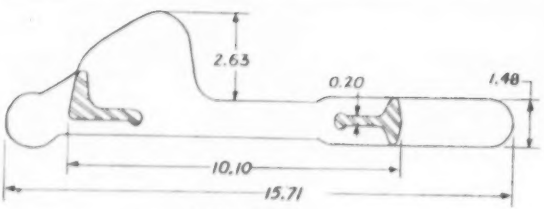

'I'-SECTION WITH WEB TAPERED TO IMPROVE METAL FLOW
R
5° to 8°
1/8 min.
PART FORGED WITH GUTTER FOR EXCESS METAL AS SHOWN
PUNCH-OUT OF WEB TO RELIEVE FORGING DIFFICULTY
DRAWING TO CALL FOR WEB PUNCH-OUT
BEADED PUNCH-OUT FOR STRENGTH AND STIFFNESS
r
R
ON SMALL PARTS WHICH HAVE FIN-LIKE PROJECTIONS FROM A GLOBULAR CENTER, MINIMUM PROPORTIONS SHOWN AT RIGHT. WEB THICKNESS SHOWN SHOULD BE EXCEEDED IF POSSIBLE, BECAUSE THIN WEBS CAUSE INCREASED PIECE COSTS
3/32 min
1 inch max for 3/32 inch thickness

Web sections . . .
for Ti forgings should follow the design recommendations shown here

Intricate Ti parts now forged in presses . . .

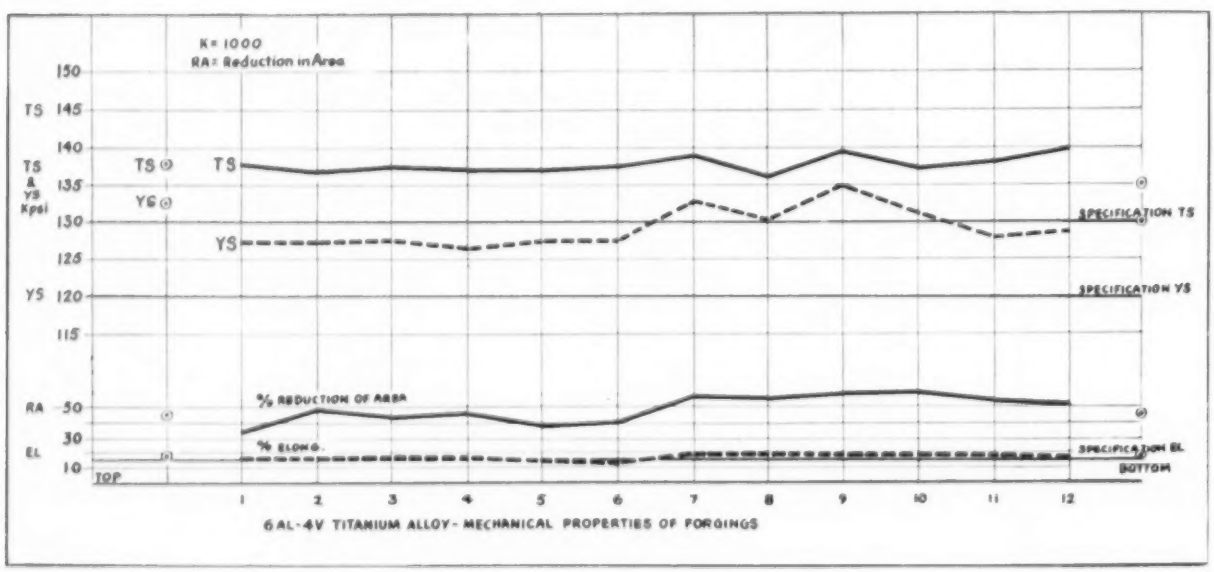

TYPICAL DIE CLOSURE . . .
0.010
0.040
NOTE: die closure on other shapes is apt to be greater
3/8
PROFILE WHICH PERMITS MINIMUM DIE CLOSURE . . .
MECHANICAL WORK-MATERIAL MOVEMENT TO FILL CAVITY . . .
AVERAGE FLOW LINES OF MATERIAL IN MOVEMENT . . .
CRITICAL AREA FOR MATERIAL MOVEMENT . . .
wrinkle or flow-thru possible here





DRAG STRUT

Complex airframe part . . .
forged from Ti-155-AX alloy. Essentially, the sequence of operations for Ti forgings start with the bar going through a preliminary die to start flow of material and to minimize wear and tear on subsequent dies. Also, use of the preliminary die gives a better distribution of material



Mechanical properties . . .
of 6AL-4V titanium alloy forgings. Encircled dots indicate average of several tensile tests made on test pieces taken from top and bottom ends of billet before forging. These data are used to decide whether or not billet is suitable for release to production. Numbers 1 to 12 represent mechanical properties of individual forgings made from this particular billet. Results on graph indicate that heats run from billet conform to a satisfactory degree

Mechanical work vs temperature

When running most Ti alloy forgings, there is no need to exceed temperatures beyond 1750 F. If forging temperature is kept between 1400 to 1600 F, contamination and surface scale can be minimized.

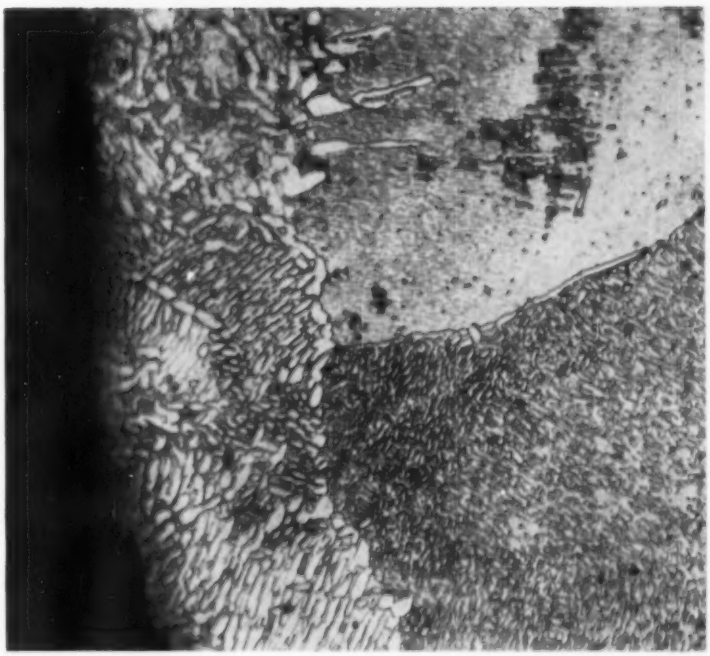
However, this is only possible when the shape of the part can be made within this temperature range. When forging temperatures run in the 1750 F range without adequate mechanical work, there is a problem maintaining the Ti mechanical properties.

After forging

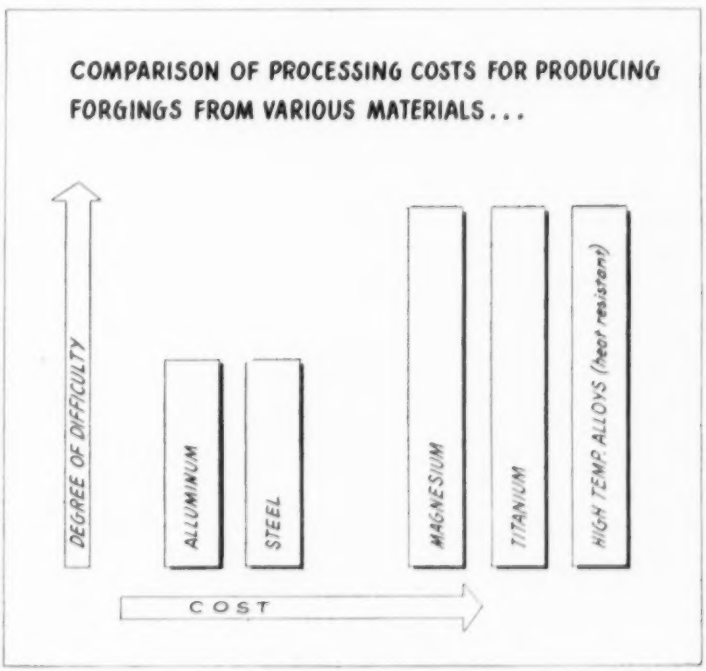
Parts are sand or shot blasted, then etched in a solution of 2 to 3% hydrofloric acid plus 25% to 35% nitric acid and H_2O prior to inspection. X-ray inspection is particularly useful on compressor wheels for detection of inclusions. Ultrasonic testing has been used on a limited scale because so few forgings have parallel surfaces. Costly titanium forgings are checked 100% for specifications on mechanical properties. Provisions are made on the initial design of every part for test pieces which may be taken from either the center of a core, a special fillet or a ring cut from the OD of the part.

Stress relieving is performed immediately after the last forging operation. Parts are held at approximately 1200 F from two to 24 hr, then allowed to cool in air. Other cycles have been developed for special applications.

Surface skin on forgings runs about 0.0035 in. and is attributed to high-temperature heating during forging. One method of removing this skin is by pickling. However, pickling is not the final solution, as there is always the possible danger of introducing hydrogen into the titanium. Rigid control must be exercised to avoid this possibility. Today's forging techniques have tended to lessen surface contamination, and indications are that even better control of forging process will eliminate this problem.



Surface skin . . .
above averaged 0.005 in. thick and was exposed to the following heating cycles: Gas-fired, rotary hearth at 1600 F for one hr, and cooled in air. Gas-fired, recirculating pit-type at 1200 F for 24 hr, and cooled in air. Electric Globar furnace at 1600 F for one hr, and cooled in air (Photo X500)

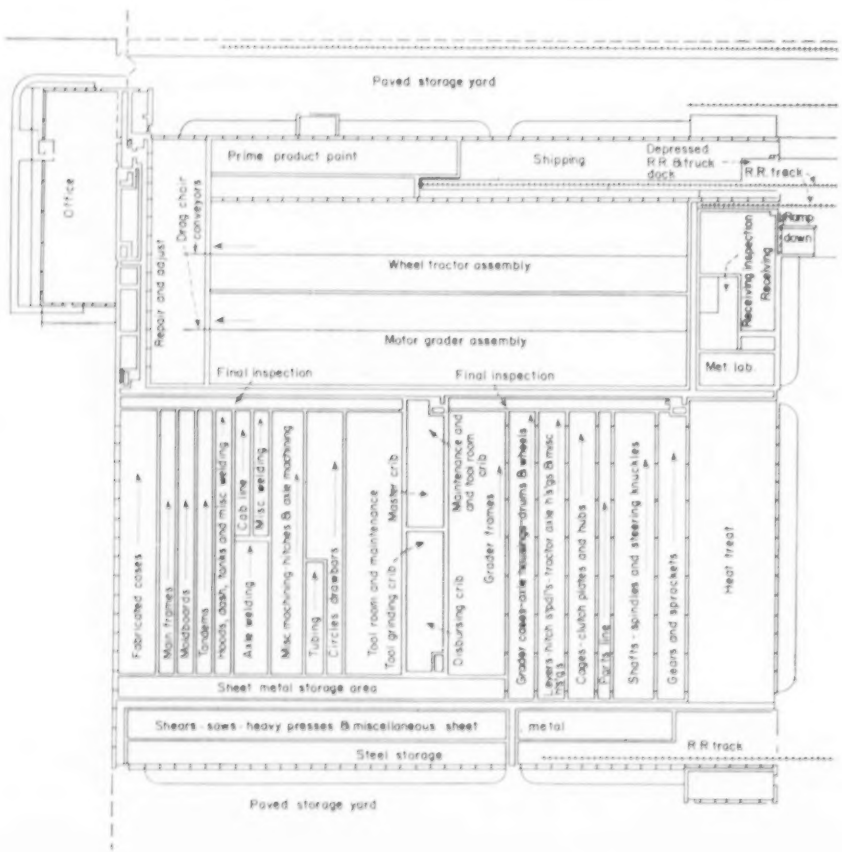


Cost of producing titanium forgings . . .
is proportional to the intricacy of the design. Contributing to the cost is not only the problem with uniformity of material but in handling and running forgings through the cycle of die stages. In the case of steel and aluminum, billets and bars are more nearly adequate and are of higher quality and consistently uniform. Magnesium is on a par with titanium, because like titanium it is a newer alloy presenting many forging problems

NEEDED IN INCREASING NUMBERS for highway and other construction projects, heavy-duty motor graders and scraper-hauling wheeled tractors now are made at Caterpillar's recently completed plant in Decatur. Motor graders, like the 115-hp No. 12 Diesel-powered Caterpillar unit shown, require strong frames, drawbars and support circles to withstand pressures of ditching and banking cuts with long blades

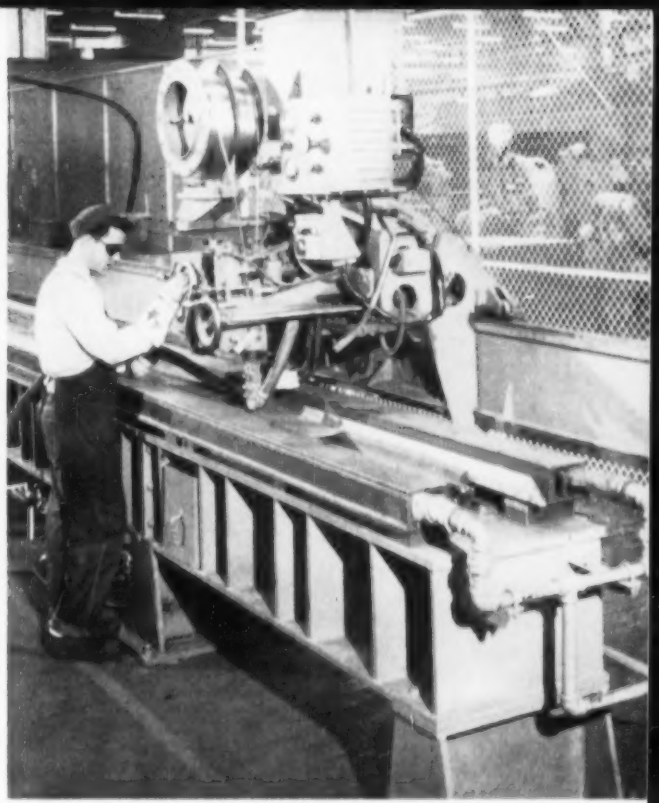
Heavy forming and welding makes

ARTHUR W JOHNSON
manager of manufacturing
Decatur Plant
CATERPILLAR TRACTOR CO



WORKPIECES AND SUBASSEMBLIES move along integrated machining lines from material-storage areas at south side of building to final inspection and assembly lines. Building features three long drag-chain conveyors, two for the assembly lines and one for the final paint line. At end of paint conveyor, hydraulic cylinders lift motor graders or tractors off supporting dollies and set them on floor for movement to shipping floor under own power. All three conveyors move continuously, at speeds to suit operations performed along the lines. Overhead crane removes units from ends of assembly lines to adjustment area for final inspection, tuneup and run-in tests prior to spray painting and shipment. Repairs also are made here

AT PROPER STATION along motor-grader assembly line, hoist lifts drawbar and blade-support circle subassembly from adjacent storage area into position for bolting to frame. Until wheels are mounted further along conveyor, frames are supported on chain-drawn dollies



LONG SPRING-LOADED CLAMP BARS actuated by compressed air in lengths of 2½-in. ID firehose hold motor-grader frame side-beam subassembly in fixture while cover plate is welded to ledges in special rolled-steel section. Lincolnweld head arc welds two beads simultaneously

earthmovers

This week Caterpillar is holding open house at its new plant in Decatur, Ill, to show friends and neighbors how huge motor graders and wheel-type tractors are made by modern manufacturing methods

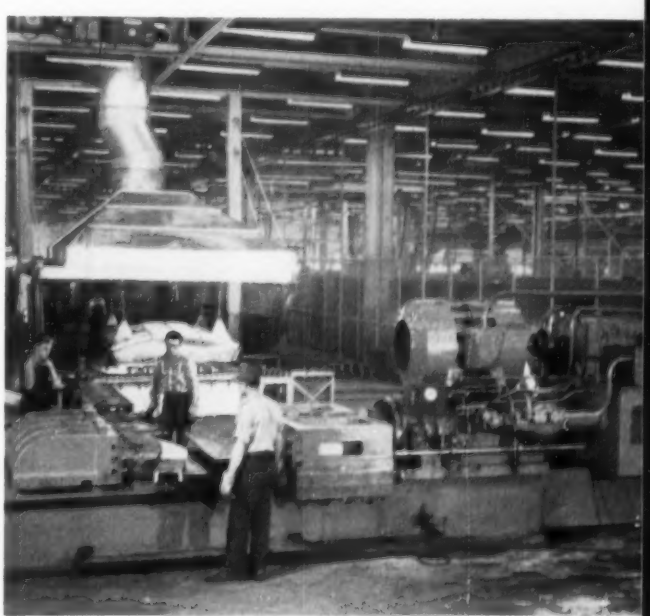
Three years ago, officers and directors of Caterpillar Tractor Co were faced with a growing demand for tractors and all types of earthmoving machinery, as well as need for additional space to make a new line of large crawler-type tractors.

Their decision was to transfer out of Peoria the manufacture of all earthmoving equipment not already produced at the Joliet Plant, as well as production of large wheel-type tractors used to power many earthmoving units. Peoria then would produce only crawler-type tractors and Diesels.

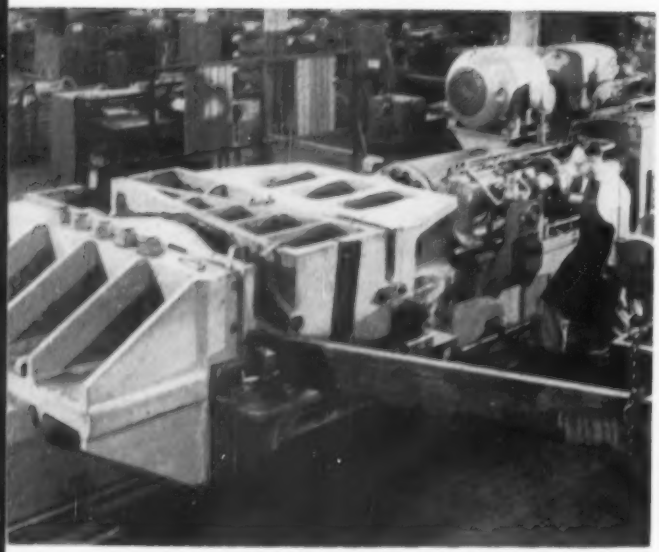
The resulting expansion and modernization program, now virtually completed, included enlargement of the Joliet Plant, major rearrangement of some sections of the Peoria Plant, and construction of a new plant at Decatur, Ill, for wheel-type tractors and motor graders.

Less than 16 months after ground (farmland) was broken on Feb 22, '54, on the 425-acre site of the new Decatur Plant, it had assembled and shipped its first motor grader. By Dec 31, '55, all operations had been transferred from Peoria.

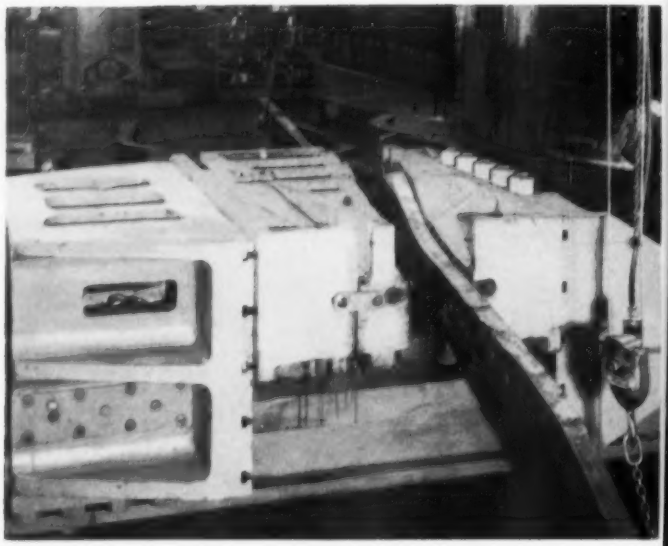
Decatur consists of 14 buildings, with 19 acres of



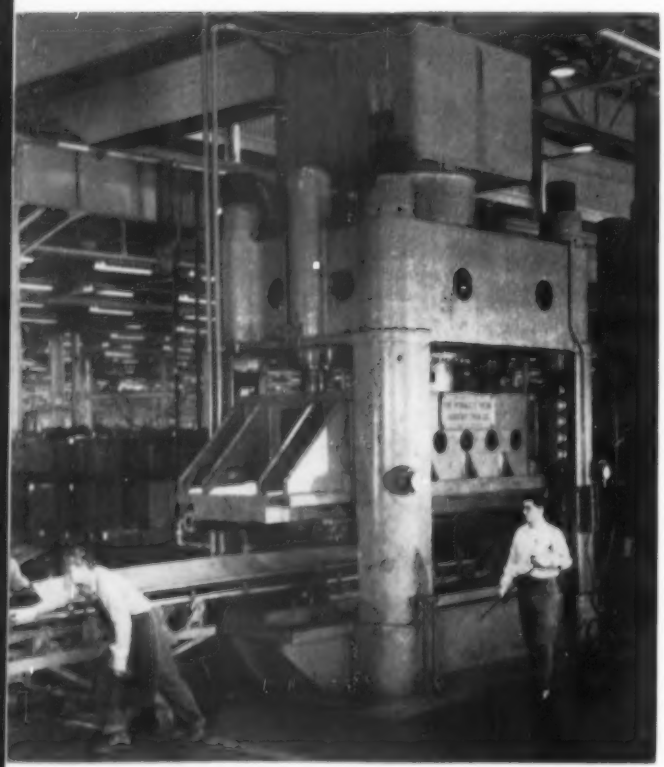
PRIOR TO HOT BENDING, motor-grader frame beams are delivered by roller conveyor to pit furnace (rear) where bend section is heated to 1800 F as beams progressively are moved across covered opening of furnace. Steel blocks welded to handles keep beams separated while they heat. Beams are bent hot in 500-ton Lake Erie hydraulic horizontal press as soon as possible after removal. S-bend is located accurately by positioning drilled hole over pin in die



FOLLOWING HOT BEND, frame beams go to second 500-ton Lake Erie horizontal press for side bending to right or left, so beams will form Y-frame when joined by welding. Three-section die permits bending both beams without tool change, by clamping center section to either side



THREE-SECTION DIE for cold bending motor-grader frame beams easily is arranged for forming right- or left-hand beams by closing dies empty, then placing tie plates to hold center section against either fixed or movable die block (as shown)



MOTOR-GRADER BLADES 12 and 14 ft long are hot (1600 F) formed from 7/8-in.-thick plates of alloy steel, 22 and 26 in. wide, in 2500-ton HPM hydraulic press. Fixture for moving blank in and out of dies is supported on carriage for moving hot blank from furnace

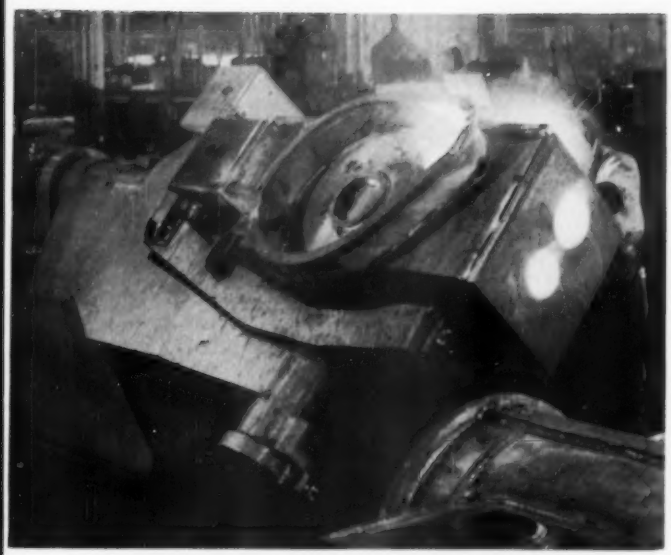
Heavy forming and welding makes earthmovers . . .

floor-space under roof. The 730,400-sq ft, 880x830-ft manufacturing building (sketch) is arranged for normal flow of raw material and parts from one side of the building, through integrated machining, subassembly and final inspection lines, to two drag chain-type final assembly conveyors, a drag chain-type final paint line and the shipping floor at the other side.

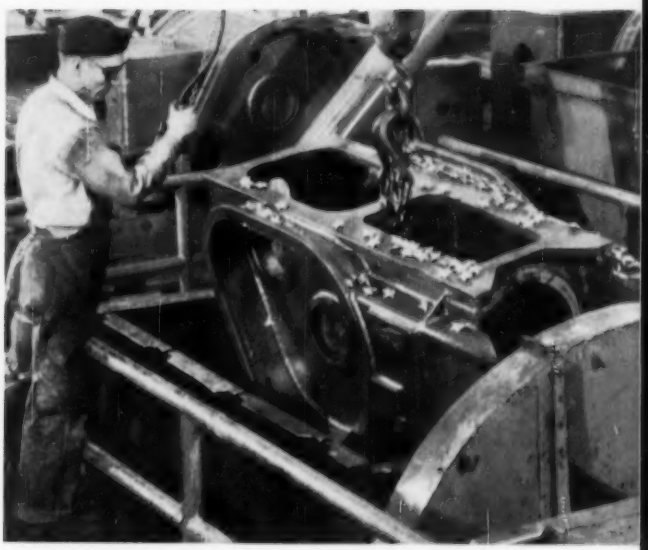
Adjoining the manufacturing building is an administration building with more than 53,000 sq ft of office space on two floors. Other nearby buildings house the heating plant, and jig and fixture storage, electrical substation, industrial waste disposal, paint mixing, lumber storage, plant maintenance and similar activities.

Unusual in its accessibility to both factory and office personnel is an 880-ft long, 57,200-sq ft, mezzanine which runs from the second floor of the office building across the entire length of the manufacturing building. It provides space for factory offices, training and safety offices, locker rooms, a conference room, and the plant cafeteria.

Changeover from construction to production was accomplished gradually. As rapidly as contractors, working under the direction of Caterpillar vice-president T R Farley, completed a major area in the manufacturing building, workers under the supervision of plant manager Warren Kinsey started



NOVEL TRUNNION-SUPPORTED SWIVELING FIXTURE supports final-drive gear case for wheeled tractor while tack-welded joints are welded manually. Fixture design permits setting weldment so all welds are downhand. Coated ¼-in.-dia rods are used with 600-amp welders



TRACTOR GEAR CASE is cleaned and peened for stress equalization by tumbling for 1-hr in 84 x 62 x 36-in. steel box supported on trunnion bearings and driven at 14 rpm by 10-hp motor. Weldment weighs approx 2200 lb and is tumbled in approx 2500 lb of 2-in. steel stars. Bearing shaft at one end is hollow so dust can be drawn out by fan

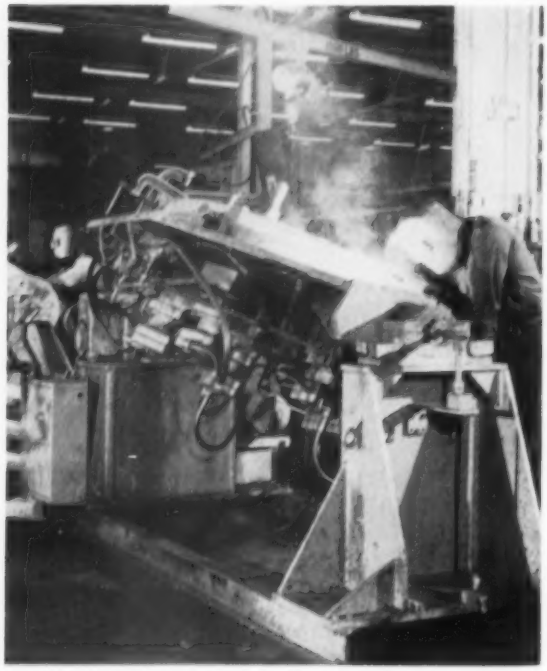
moving in machine tools and other manufacturing equipment.

When production facilities were ready for the manufacture of motor graders, a Peoria-built grader was taken to Decatur, placed at the end of the new motor-grader assembly line and moved backward down that line. As it passed succeeding assembly stations, the machine gradually was taken apart, piece by piece—in the reverse order that motor graders later would be put together at the same

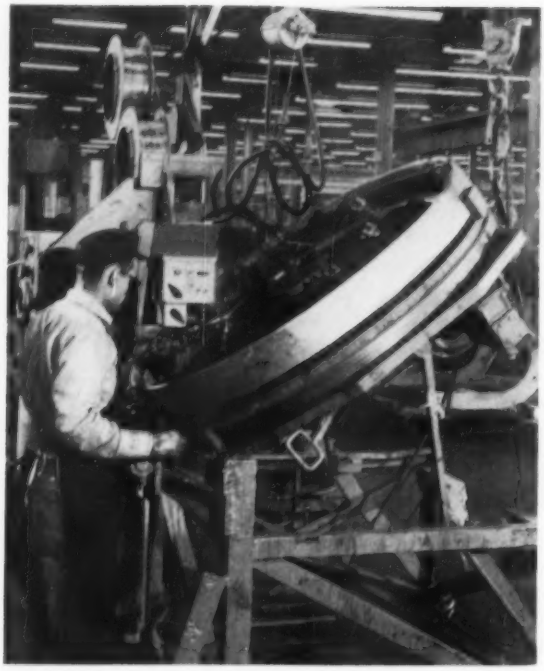
REINFORCEMENTS AND ANGLING BLADE are submerged-arc welded to back of press-formed grader blade with Lincolnweld head on traveling carriage. Trunnion fixture holding blade is mounted on casters so weld can be aligned accurately. Six ¾-in. fillet welds are made

MOTOR-GRADER BLADE-SUPPORT CIRCLES are hot formed in heavy-duty Williams & White Bulldozer from straight specially rolled sections heated to 1600 F in adjacent gas-fired furnace. The 60-in.-OD, 50-in.-ID circles are finished in 5 to 7 minutes

Heavy forming and welding makes earthmovers . . .



TILTABLE FIXTURE with hydraulic clamps is used to tack-weld reinforcing ring inside motor-grader blade-support circle. As with most other welding operations, ¼-in.-dia coated rods are used with 600-amp ac transformer-type welders, and all welds are downhand



REINFORCING RINGS are submerged-arc welded inside blade-support circles with Lincolnweld heads in two operations. Fixture is tilted with hoist (above) for ¾-in. fillet weld inside assembly, then lowered to horizontal position for ½-in. fillet weld on face joint

INTERNAL CYCLOIDAL TEETH in blade-support circle are cut two at a time with HSS cutters in Caterpillar-designed gear notcher. The 64 teeth are cut in 32 automatic machine cycles, then machine stops automatically

stations. Assembled units taken off the machine were, in turn, disassembled along the subassembly lines. Finally, each part was placed in its proper bin.

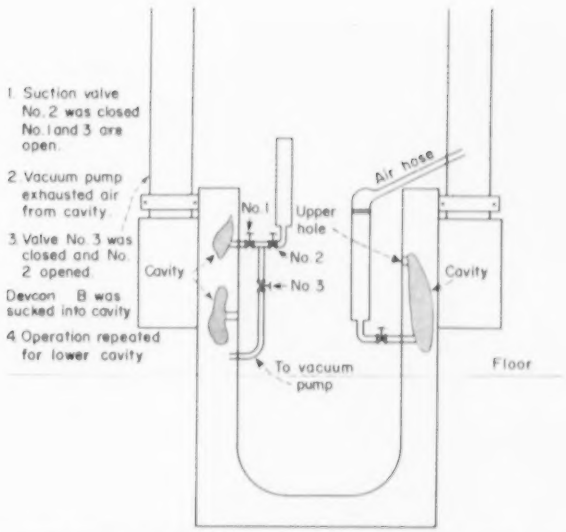
Our objective was to verify the locations of parts bins, tooling and handling devices along the motor-grader assembly line. By the time we had stripped the test grader down to the frame, we had found several necessary relocations of tools, hoists and bins. In addition, the new men along the assembly line became familiar with the component parts of a motor grader.

Within two weeks after the dismantling "trial run" was completed, the first Decatur-built motor grader rolled off the line on June 6, '55. Right behind it was a conveyor line loaded with motor graders in various stages of assembly. Production was proceeding smoothly, without the irritating delays common to new assembly lines. Later, when production of wheel-type tractors was started, similar techniques were employed.

Important innovations at Decatur include concrete floors in the steel storage, adjustment floor and shipping areas, instead of the wood-block flooring generally used; color-corrected mercury-vapor lights in some high-bay areas where concentrated lighting is preferable to the general illumination provided by fluorescent fixtures; and traveling cabs on the two 15-ton, 100-ft-span overhead cranes, so operators can see exactly where they are positioning loads.

"Plastic steel" plugs casting cavities

Rescuing the main hydraulic cylinder of a powder-metal press at Amplex Div, Chrysler Corp, saved an estimated $25,000 and 30 to 60 days of downtime. Repairs took less than a week, and cost under $1000


1. Suction valve No. 2 was closed No. 1 and 3 are open.
2. Vacuum pump exhausted air from cavity.
3. Valve No. 3 was closed and No. 2 opened.
Devcon B was sucked into cavity.
4. Operation repeated for lower cavity.
Air hose
No. 1
Upper hole
No. 2
No. 3
Cavity
Cavity
To vacuum pump
Floor

TWO SMALLER CAVITIES IN LEFT CYLINDER WALL were filled by creating partial vacuum inside, then letting plastic-steel material run in by suction. Larger hole, right, was drilled twice, then material forced in under 300-psi air pressure

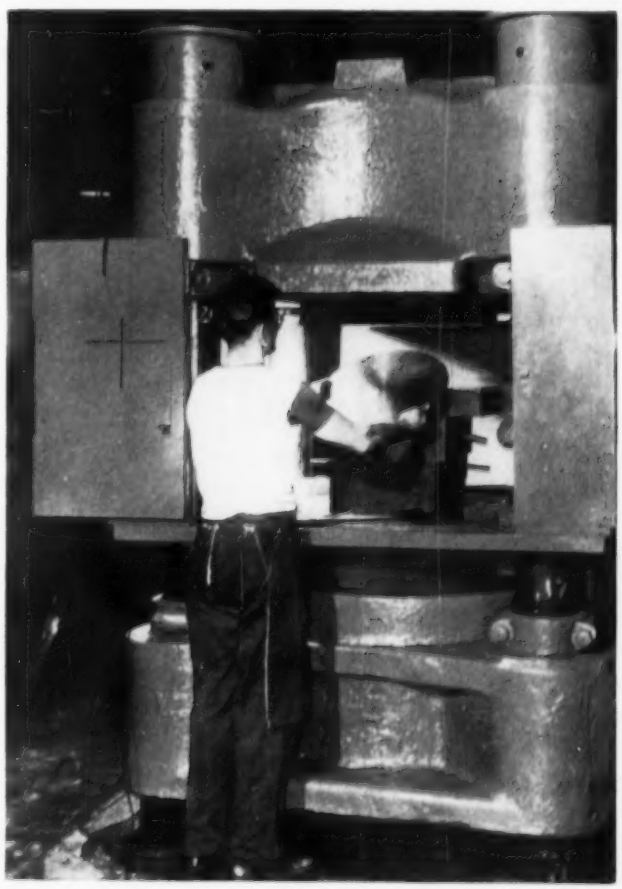
Three casting cavities, and constant pounding during press operations, finally produced cracks and leaking in the base of this heavy press. Nominated to do the repair work, the Maine Engineering Co of Detroit decided on Devcon, which is 80% steel, 20% plastic, to plug the holes.

The job went this way: First the holes had to be found. This was done by drilling test holes in the casting. Then they had to be cleaned, because they were loaded with hydraulic fluid and sludge. This was done by flushing them steadily for two days with solvent.

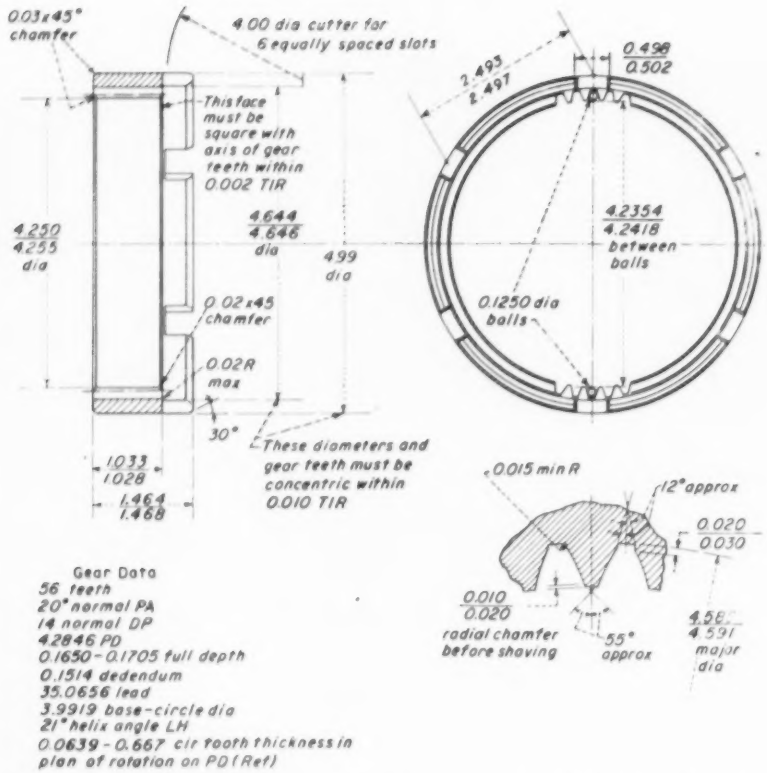
One drilled hole was left open, after cleaning, in each of the smaller holes; two in the larger one. Devcon B, a liquid formula, was forced into the three holes, allowed to dry for 24 hr, then the cylinder wall was ground flush.

The material is mixed with a hardening agent and allowed to dry for at least two hours. Afterward, it can be machined with regular metalworking tools. In the case at Amplex, it filled one hole about 20 in. long and 1 to 4 in. deep, plus two smaller holes.

After the machine was put back in service, a small bleeder leak at the bottom of the base was found. This was patched on the outside with Devcon A, a putty-like form of the same plastic-steel material. Subsequently, no leaks have developed.



POWDER-METAL PRESS THREE MONTHS AFTER REPAIRS shows no sign of leaks around cylinder, in machine base. Press has 3000-ton capacity, believed largest in the industry


0.03 x 45° chamfer
4.00 dia cutter for 6 equally spaced slots
This face must be square with axis of gear teeth within 0.002 TIR
4.250 / 4.255 dia
4.644 / 4.646 dia
4.99 dia
0.02 x 45 chamfer
0.02R max
30°
These diameters and gear teeth must be concentric within 0.010 TIR
1.033 / 1.028
1.464 / 1.468
2.493 / 2.497
0.498 / 0.502
4.2354 / 4.2418 between balls
0.1250 dia balls
0.015 min R
12° approx
0.020 / 0.030
0.010 / 0.020
radial chamfer before shaving
55° approx
4.58 / 4.591 major dia
Gear Data
56 teeth
20° normal PA
14 normal DP
4.2846 PD
0.1650 - 0.1705 full depth
0.1514 dedendum
35.0656 lead
3.9919 base-circle dia
21° helix angle LH
0.0639 - 0.667 cir tooth thickness in plan of rotation on PD (Ref)

NEARLY 6 FT LONG and weighing about 700 lb, one of the broaches for internal transmission gears produces a 73-tooth helical gear nearly 6 in. in dia and 1 in. wide in a single pass. Typical is the 56-tooth front internal gear, later assembled with a flange and hub by means of automatic welding. Broach holds involute, both sides, to plus zero, minus 0.0005 in. All critical dimensions are held within 0.0002-in. tolerances, and, as a result of special heat treating, broach life runs about 40,000 pieces before it is scrapped. This is expected to go to 60,000 pieces or more.

Internal gears broached, welded automatically to slash costs

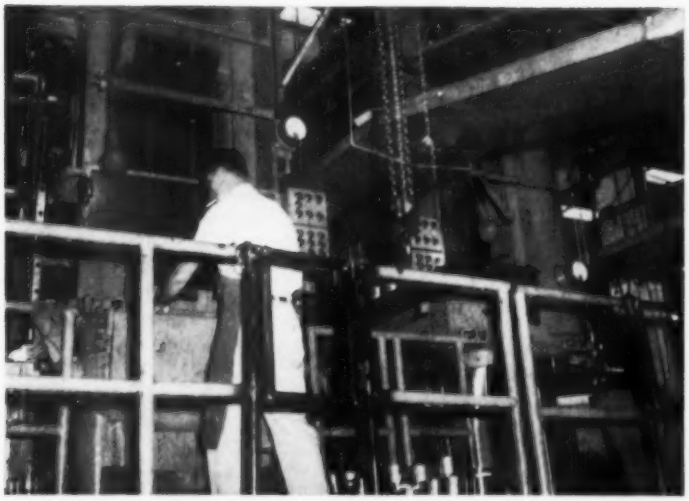
Compared with former methods, higher production rates, greater accuracy, and finer finishes are gained with special broaching setups on large helical internal gears for automatic transmissions. On top of this, special welding equipment automatically adds hubs and flanges. Result: more and better parts at lower costs

WILLIAM G MERTENS, chief metallurgist
Detroit Transmission Div.
GENERAL MOTORS CORP, YPSILANTI, MICH

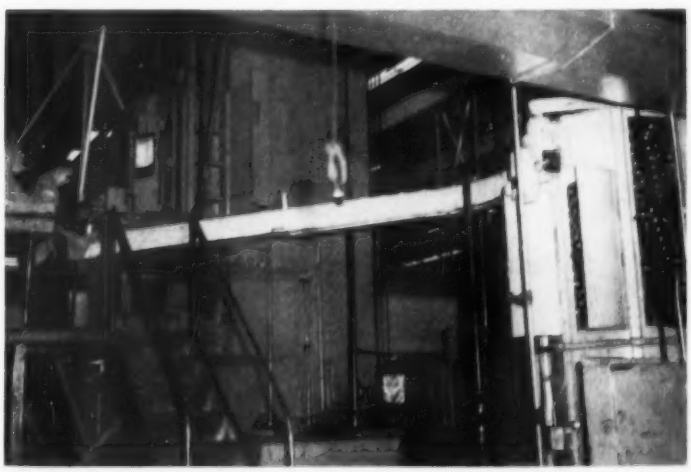
Higher production rates were the big reason for investigating broaching of helical internal gears at Detroit Transmission. Considerable development work at the plant and by broach suppliers gave the desired result—plus a number of other advantages. For example, lead and involute profile are held to closer tolerances with considerably less trouble because these characteristics are built into the tool. Broaching and shaving produce the gear-tooth form. Substitution of broaching for shaping has reduced operating costs 37 to 75%.

METALLURGY IS CONTROLLED

Gears are made from SAE 5140-H steel tubing, heat treated to obtain optimum microstructure. This is essential not only for broaching (for good finishes and to increase tool life), but also for best machining conditions in other operations. First step in producing front and reverse internal gears, for example, is turning, facing, chamfering and cutting to length in automatic



OVERHEAD CONVEYORS transfer blanks for front internal gears to two LaPointe machines where they are nested on the ODs and located against gear end faces. Machines are 50-ton capacity with 72-in. stroke, operating at a broaching speed of about 14 fpm. Automatic ejection transfers the gears to a special 2-spindle Sundstrand machine where six equally spaced slots are milled in the face opposite the gear end



HIGH-VOLUME PRODUCTION is facilitated by automatic materials-handling equipment at broaching setups. Here a storage and distribution unit delivers blanks to two Colonial machines tended by one operator. Broached gears are automatically ejected into a chute for transfer to burring and shaving

bar machines with carbide tools. Boring, finish facing, finish chamfering and counterboring follow, with a cutting action quite different from that in the bar machines. Here, too, microstructure must be suitable. Remaining operations are broaching, shaving, milling slots, and finish grinding the OD—each with a cutting action different from those that preceded them.

Because it is impossible to develop a microstructure ideal for every operation, plant metallurgists have settled for one optimum structure that generally suits all machining requirements. This is a blocky structure of ferrite and very fine pearlite, with a minimum of open laminar structure. Although an open laminar pearlite structure is excellent, for bar-machine operations, a tighter structure is required for best results in boring and it should be even closer for broaching. Purchased tubing must meet rigid specifications and is carefully inspected for hardness and analysis.

MECHANIZED SETUPS

Broaching follows finish facing, and is done on special equipment. Machines have either mechanical or hydraulic drives. All however, are 50-ton capacity, 2-station, pull-up machines. Two Colonial machines, for example, have two stations—each of which broaches two gears at a time because part design permits stacking. Two LaPointe and three American broaches also have two stations each that broach one gear at a time. In all these setups, mechanization is employed. Conveyors carry blanks to the LaPointe and American machines where they are stacked in nests. After the broaching pass, gears drop into chutes for transfer to subsequent operations.

A higher degree of automatic handling is employed at the Colonial machines. Machined blanks are loaded into a Feedall unit first, transferred to a Gardner grinder for face grinding, then automatically delivered to a feed and storage unit for distribution to the machines.

Broaching speeds are about 10 to 14 fpm, with a lard-and-sulfur-base cutting oil. A "big bite" is taken by round buttons in the roughing section to remove 0.005 in. per side instead of the usual 0.0005 in. from the ID of the blank. This is done to get under work-hardened ID surfaces produced by bar-machine operations with carbide tools at extremely high speeds. Both rough and finishing cuts are made in one pass with 81 - in. - long specially developed broaches.

Specifications by Detroit Transmission included the requirement that these broaches be interchangeable among all broaching machines. As a result, a high degree of flexibility has been gained. For example, two different parts can be run on one machine simultaneously because broaches for each will fit both stations. In addition, broaches can be removed from a down machine and placed in another without time-consuming and costly modifications.

Internal gears broached . . .

SPECIAL BROACH DESIGN

Design innovations in broaches include tooth-protuberance and tooth-chamfering elements. Teeth on the broach have a special protuberance form that provides clearance in the bottom of the gear-tooth spaces for the tips of the shaving cutter. Gear-tooth edges at the ID are chamfered by the broach as it produces the teeth. ID of the internal gear is also finished by integral rings near the end of the broach as it passes through the gear blank, thus insuring a high degree of concentricity between the PD and ID with the sides of the gear teeth.

These tools are spline ground from the solid on a machine equipped with a special headstock, a master lead bar and automatic index mechanisms and wheel trimmers. To hold 0.0002-in. tolerances on the finish-shaved gears, the broaches require a high degree of accuracy on helical leads, involute forms, circular tooth thickness, and spacing over the entire length.

For maximum fiber strength and hardness, combined with toughness, the 18-4-1 HSS broaches are heat treated to transform the metallurgical structure to uniform tempered martensite. In addition, a special surface treatment is performed to obtain high resistance to abrasion and corrosion. This eliminates objectionable soft skin which can result from tooth grinding and adds from 50 to as much as 700% to the service life of the tool. As a result, broaches do not load up, gall, or pick up metal in operation. Average number of gears broached between grinds runs from 1200 to 1300.

BROACHING HOLDS ROUNDNESS

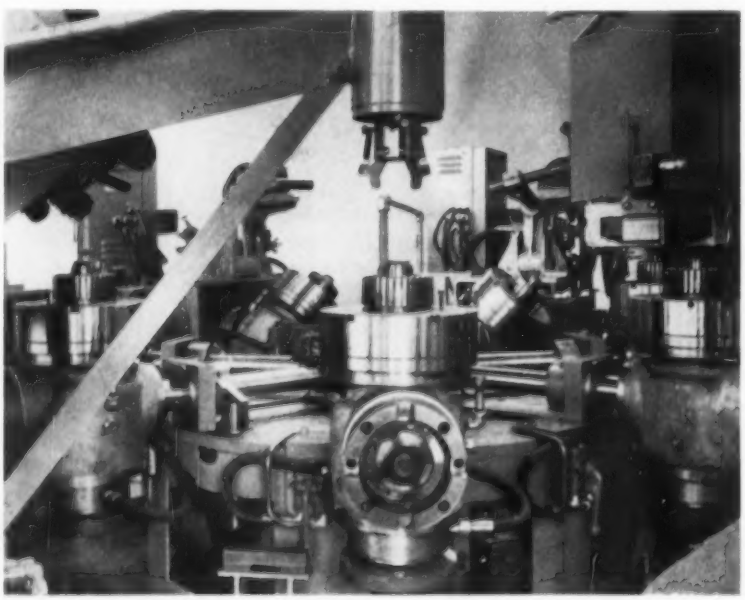
Among advantages gained by broaching is the elimination of out-of-roundness sometimes experienced with shaping where non-uniform stress relief is the result of stock being removed a bit at a time from each section as the part is indexed. Starting with a round blank and removing stock all over at once eliminates this tendency. Of course, broaching doesn't correct out-of-roundness if it is present in the blank at the start, and, to hold 0.002-in. tolerances on concentricity of the OD relative to the ID, the blank must be made to this degree of accuracy. Blank requirements specify the ID to be round within 0.002 in. and the faces flat and parallel within 0.001-in. TIR before broaching. After the OD is finished, gear teeth must be concentric with the OD within 0.002-in. TIR prior to shaving. Gear teeth are burred after broaching, then shaved in Michigan Tool and National Broach radial-feed shaving machines. Maximum finish after shaving is 50 mu in, rms, and a maximum crown of 0.0002 in. is produced.

Front internal gears have six equally spaced ½-in. wide slots milled around the periphery of the counterbored face before the OD is machined and the teeth burred. This is done in special Sundstrand indexing machines at high production rates. After shaving and inspecting, all gears are washed, then heat treated. Controlled-atmosphere furnaces are employed, with a neutral gas with a carburizing gas additive at a temperature of 1525 to 1550 F for about 55 min. A Gleason quenching machine and dies then quench the gears, holding distortion to a minimum. Parts are washed, then automatically loaded into another furnace for tempering. Here the gears are held at a temperature of 400 F for one hour to reach a hardness of R_C50-56. A vapor-blast operation, with parts loaded and unloaded automatically, cleans the gear teeth of objectionable heat-treat surface contamination.

AUTOMATIC WELDING

Part of a transmission gear is a low-carbon stamped hub and flange subassembly welded together by a shielded inert-gas metal arc-welding setup. This component is then joined to the 5140 gear. A special 6-station indexing machine, developed by Expert Welding Machine Co, presses the flange and hub subassembly in place in the gear, preheats the unit, welds and wire-brushes it, then automatically unloads the finished part.

In this setup, parts are manually loaded into air-powered clamping fixtures at the first station. Actuated by cams, these fixtures are tilted to various angular positions during indexing through the work cycle and gear drives rotate the parts at welding and wire-brushing stations. Jaw-clutch halves in



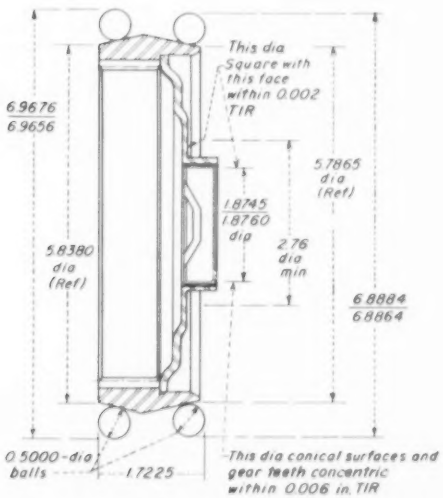
SPECIAL AUTOMATIC WELDING equipment joins hub and flange sub-assemblies to broached gears within plus or minus 0.001-in. concentricity between hub and gear PD. Pushbutton controls initiate the automatic cycle, and manual control buttons permit separate and independent operation at each of seven stations. Work is manually loaded, pressed and preheated, welded, wire-brushed and automatically ejected

fixtures are engaged by mating clutch halves in motor drives at these stations.

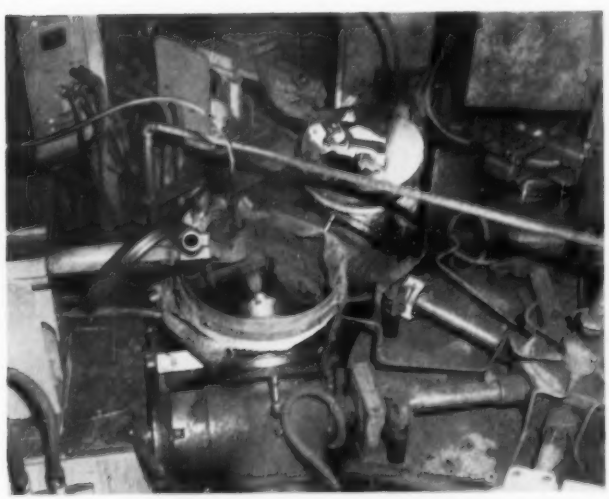
At the second station, a counterbalanced press that can float up and down to accommodate the fixture without deflecting the index table presses the parts together. A plate on the bottom of the fixture rests on the press bed during the operation so no pressing loads are transmitted to the index table. An interference fit of 0.002 to 0.006 in. is produced with the pressing operation, while an induction coil on the pressing head preheats parts to 500 F max in 4½ sec. This minimizes the tendency to underbead cracking in the weld by slowing up the cooling rate after welding.

As the work is indexed to the third station, the fixture is tilted to a 45° angle for argon-shielded arc welding three running spots 120° apart and about ½ to ¾ in. long. A Linde welding head is set up vertically for zero lead and delivers 0.040-in.-dia "Oxweld 65" wire—a mild low-carbon material—to the joint at 600 ipm. Direct polarity is employed, with a current of 300 to 350 amp and a welding potential of 25 volts. Work rotation speed is 60 ipm at the weld positions, 170 ipm between them for fast approaches.

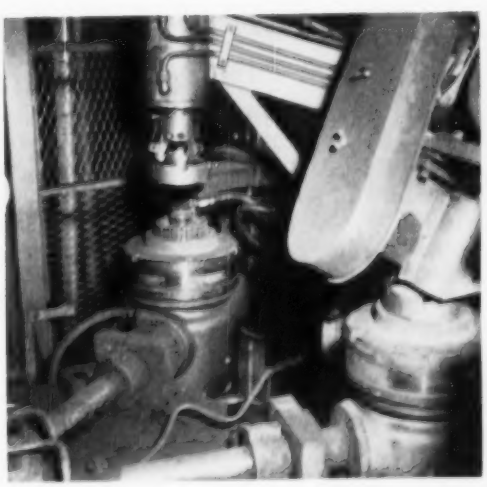
At the fourth station a second set of running spot welds is produced equally spaced between those already made, employing a similar setup. The fifth station is idle and as the fixture is indexed to the sixth station it is tilted back to the vertical for the wire brushing. Here an air-cylinder-controlled, motor-driven wire brush is lowered to engage the joint while the work is rotated to remove excess weld spatter. At the seventh station, a mechanical pick-up arm, controlled by an air cylinder, removes the finished gear and automatically loads it onto a conveyor for delivery to an automatic postheat furnace, which further insures freedom from underbead weld cracking.



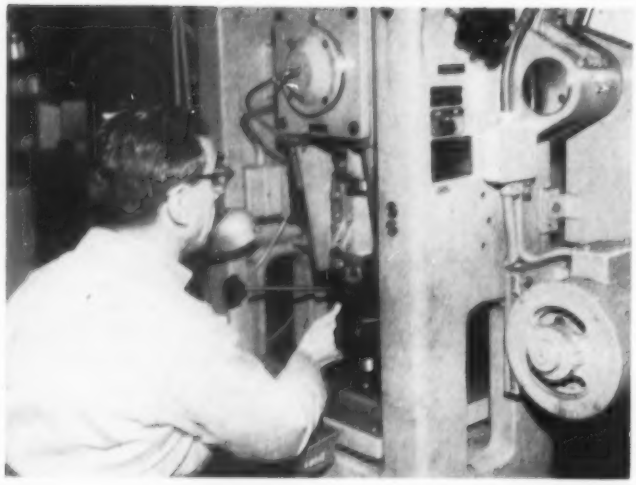
WELDED ASSEMBLY of reverse internal gear with hub and flange requires 20,000-lb load to break. Spot checks are made to determine whether the flange breaks under this load (indicating a good weld) or if the joint shears. A high degree of concentricity is required in the assembly, together with a strong joint

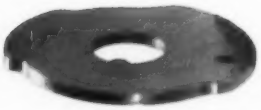


WORK FIXTURES ARE TILTED 45° for automatic welding after components are pressed into position and preheated. Fixture faces are located radially and locked in position for welding by four rollers that engage them after they index to this station. Three equally spaced running spots are produced at the first welding head, three more at the second



AFTER WIRE BRUSHING to remove excess weld spatter, welded assemblies are picked up by air-cylinder-controlled mechanical fingers and ejected from the machine. Rotary indexing table is powered by a motor and clutch as well as a cam-indexing mechanism. Air-powered chucks on each fixture have control valves that travel with them and are automatically operated at the press station by an auxiliary air cylinder. They are cam released as the fixture moves into the unloading station





FIRST FRIDEN TEST PART is this stainless-steel cam about 1¼ in. at its widest and 1/16 in. thick. With careful selection of lubricant and diamond-lapped die of zero clearance, a finish approaching 2 mu-in., rms, is produced

THIS SMALL PRESS, made in Switzerland, incorporates a second slide within the ram, so the punch reciprocates at 1200 strokes per minute as the ram descends. It can produce 30 ppm, has a cutting stroke of ½ in., total stroke of 1¼ in., with 2-in. slide adjustment

Vibration does smooth shaving

Special press at Friden converts an old nuisance into a productive force, achieving high finishes on stainless-steel parts

Vibration has in most cases been a much-maligned and to-be-avoided force in Metalworking, but there have been occasional efforts to make use of it. And there has always been a staunch body of supporters who felt that, intelligently used, vibration could assist, rather than disrupt, the cutting process. We remember the Purdue professor who utilized lathe vibration to create "controlled chatter" whereby he simulated the staves in a miniature aluminum barrel. Another case, just at war's end, was that on Long Island, where a relatively high—but controlled—vibration rate was put into a miller table. Much higher feeds and speeds were possible, but close study indicated that it was the high-rake cutter, rather than the vibration, that was achieving the results in that particular case.

Both of these examples used vibration applied normal to the direction of cutting. The ultrasonic method of cutting, on the other hand, supplies a very-high-cyclage vibration in the cutting direction, the cutting medium being boron-carbide grain between tool and work. The effect is to hammer the grain against the grains of the work, dislodging the latter.

Friden Calculating Machine Co, Inc, San Leandro, Calif, has recently also been experimenting with vibration as a cutting force, but at far lower speeds. Engineers there have applied a special shaving press to shave cams and other parts of stainless steel. The effort has been to achieve a high degree of finish on the shaved surfaces without grinding or other further finishing. A typical cam produced this way is pictured.

The machine used is an Essa press, made in Switzerland and seen at last year's European show by Roy Renholts, Friden factory manager. It was sold to Friden by Carl Hirschmann Company, Inc, of Manhasset, NY, and is in effect a combination. Basically, it is a vertical toggle press which has a slide with fixed travel, raised by heavy springs to avoid upward play. This slide is in itself actually a small press which produces vibrations by means of an eccentric shaft, coupled to a flywheel and driving, through a connecting rod, a smaller slide which thus reciprocates at 1200 strokes per minute. Travel of this inner slide is of course very small—about 0.020 in.—and it vibrates about 250 strokes per inch of ram travel, or about 16 times in shaving the 1/16-in.-thick cam pictured.

The die has zero—or even negative—clearance for half its thickness, and the surface is diamond lapped. The maker recommends that the punch be 0.007 to 0.020 in. larger than the die. His theory is that the punch will never approach closer than 0.015 to the die and that one part will push the preceding one through. Friden has, however, gotten just as good results with a punch that fits the die; this has the great virtue of not wrecking the die if it hits during setup or at any other time.

The punch can also do internal shaving—in suitable cases—at the same time as external shaving. Internally shaved pieces do not pass through the die, but are removed from the punch by a mechanical extractor built into the machine. About 10% of the thickness of the blank is allowed on each edge for shaving. The unit has been extensively used in Europe for clock, watch, and instrument parts, but is new here, as is this application of the principle.

Defense demands them, so here's . . .

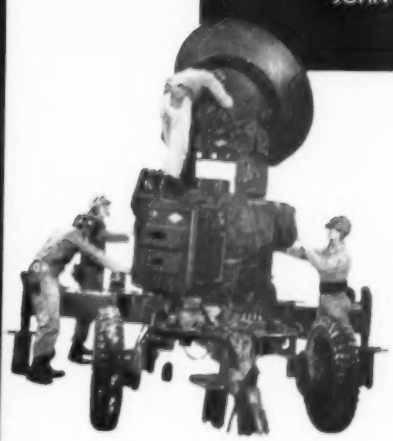
How Sperry plans to make . . .

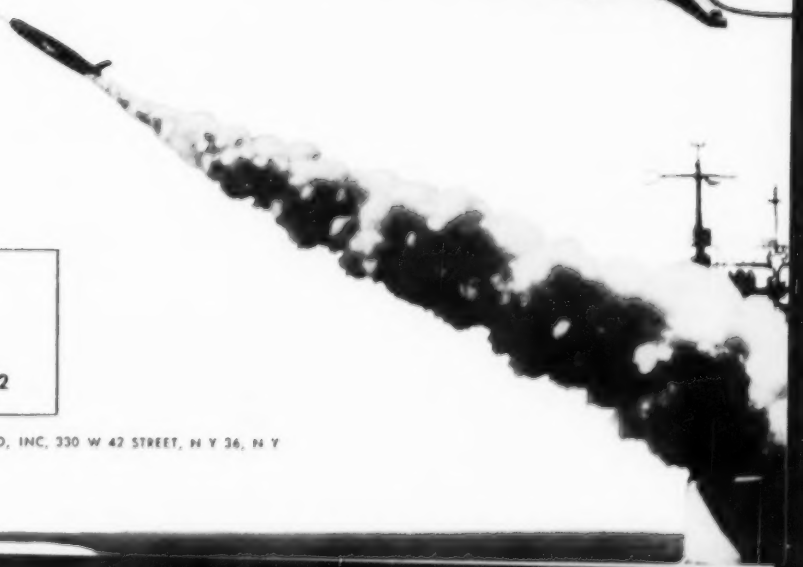
THE WORLD'S MOST ACCURATE GEARS

Half-million-dollar program involves new machine, new methods, new inspection techniques that result in stainless spur gears with "non-adjacent tooth error" less than ten seconds of arc. A survey of steps that "pick up millionths" all along the line to produce ultra-precision components for forthcoming radar, navigation and sensing equipment.

E J TANGERMAN, executive editor

JOHN P WRIGHT, associate editor





American
Machinist
SPECIAL REPORT NUMBER 422

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Why such accurate gears?

Rapid increases in aircraft and missile speeds and ranges force greater gear accuracy—in speeds because of supersonic airplanes and guided missiles that must be intercepted and destroyed farther from their targets, in ranges because of long-distance flying and high-level bombing, where a very small error in angle means a relatively much greater one in distance.

Control is, as always, the problem. Present systems inevitably introduce human error—greater as distances increase. Angles are set on relatively small shafts in very confined areas. A sensing device applied directly to the shaft either cannot detect small angular errors, or is not flexible enough to measure exactly a large angular displacement. The problem has always been one of angular error related to linear distance. Shaft movement must be multiplied by gears so a selsyn can control it or measure it, and unless these gears are exact within hitherto-unheard-of accuracies, the system cannot meet requirements. And the requirements for accuracy will become tighter, not looser, as time goes on.

There are really four separate problems, all forcing the same solution—greater gear accuracy:

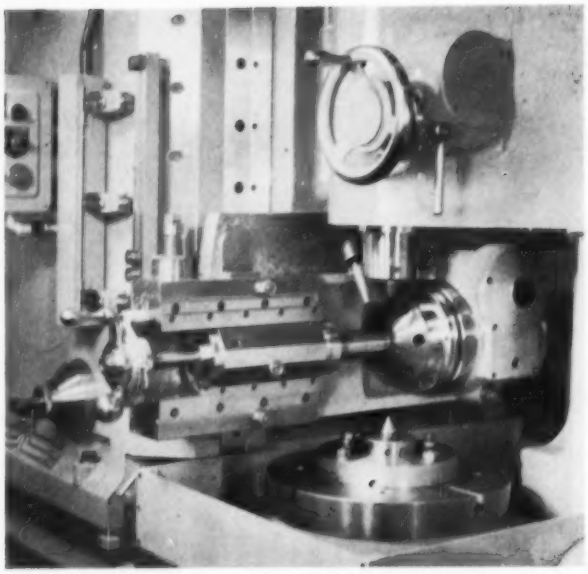
Problem I . . . Distance: Navigation of long-range aircraft and missiles. The plane that did well to fly 200 miles today flies 3000 miles (or more, with refueling from tanker planes that must be exactly met). As flights lengthen, a tiny angular error in system sensing becomes miles of distance from target. (A 1-min. angular error means one mile off target at 5000 miles. Five years ago, a 1-mile error was good enough—it is no longer.)

Problem II . . . Speed: Anti-aircraft missiles depend upon radar tracking and minimum "dead time" between receipt of initial data and contact of missile and target. As missile speeds go up, tracking must be more accurate so intercepting missiles can be dispatched earlier and meet their targets at a safe distance from the target area. The intercontinental ballistic missile is an extreme aggravation of this general problem.

Problem III . . . Accuracy: Bombing aircraft are being forced to higher and higher elevations, yet higher accuracies are required. In World War II, our precision bombing averaged a mile off target from 20,000 ft. By 1946, accuracy required was beginning to halve that. Now, two orders of magnitude greater accuracy is desired! Sighting from high altitudes must be done by radar, and any angular error is fatal to accuracy.

Problem IV . . . Tracking: Radar tracking of missile such as mortar or artillery shells from their sources must be rapid and accurate to locate the source. The problem is akin to Problem II, particularly in tracking high-speed missiles of the intercontinental and long-range type.

Solution to I, II, III, & IV: A gear with non-adjacent tooth spacing accurate to 10 seconds or less of arc (or more properly, angle) at any point and any diameter along the tooth profile and with tooth faces parallel.



Something new . . .
A new arrangement characterizes the "Ultracision" hobber. Capable of handling gears of diameters to 10 in., with pitches up to 32, this is the heaviest and most-rigid machine Barber-Colman ever built—about a ton heavier than the hydraulic model capable of pitches up to 3½. The top surface (here mostly hidden by the guard) and sides of the table are scraped to within 0.0001 in., there is no hob-indexing mechanism (to avoid one more motion), and hobs are held on a Scully-Jones expanding arbor. All slides are on bearings—there are no clamps or gibs. Thus far, faceplate fixtures replace centers

accurate

Gears accurate to ten seconds of arc over non-adjacent teeth at any point of the profile—not just the pitch line—and concentricity within 0.000010 in. in a 4-in. diameter? Ridiculous! Or so thought most people four years ago. But now one maker of gears is almost there. Sperry Gyroscope Company, Great Neck, NY, is nearing success in its half-million-dollar program.

Long before 1951, Sperry engineers began to realize that such gears would be essential before too long in navigation, missile-guiding and radar devices (for the reasons, see box at left). Tolerances were steadily tightening, and Sperry manufacturing equipment was at its limit of accuracy. Survey of some 100 vendors in this country and Europe (Swiss, German, English, French, and Italian) showed they couldn't do much better on a production basis.

Machine-tool builders were pleased to suggest processes and machines, but they felt the tolerances were too close. Resurvey of the outlook indicated that neither vendors nor machine-tool builders showed any apparent trend toward tolerances of the order Sperry wanted—the demand wasn't there . . . yet. But developments during the study period convinced Sperry engineers the demand for tolerance reductions would continue. The only solution seemed to be for Sperry to undertake the work itself as a special problem.

Obviously, machine tools alone were not the answer. Locations for such tools, new inspection and measure-

Checking proof diameter . . .
Hob proof diameter is checked with a 10,000-amplification Sheffield Precisionaire gage. Runout measurements taken before and after hobbing are compared for deviations. Here Mr Ross (see cover) tabulates data. The gage stands on the case over change gears. Scraped table sides are painted for protection

Burr check . . .
Break-away and shape of burrs are quick clues to pending trouble. Charles Aldino, product-methods gear engineer, trains an experienced eye on burr formation with the help of a low-power magnifier. Non-uniform blank material, hob dulling, and effect of feed rates can be spotted during hobbing

to ten seconds of arc...

ment equipment, and a big investment in time and research were also involved. Management approval was obtained for a new facility, and the work begun. The first step was to set aside a special laboratory—actually a totally enclosed area with its own air-conditioning and humidity-control system. It was isolated from machining areas so research and development could be done, away from areas of heavy traffic, and equipped with special personnel.

In this area, a special gaging room was installed, supplementing temperature and humidity controls with dust control (a Cambridge mechanical filter effective to 0.3 micron) and lint-free clothing for inspectors. Here, a relatively short study indicated that conventional measurement devices, using masters, were inadequate except for normal production inspection, and that equipment would have to be developed which would relate gear errors to geometry and function.

Meanwhile, engineering and manufacturing evaluation of the involute form and 14½° pressure angle indicated that geometric properties were at least as good as those of any other form for the ultra-precision tolerances required. While all errors—profile, thickness, spacing and the like—had to be minimized, spacing was the most important. The real criterion for the product was that errors over any two or three teeth be under ten millionths at any point of contact.

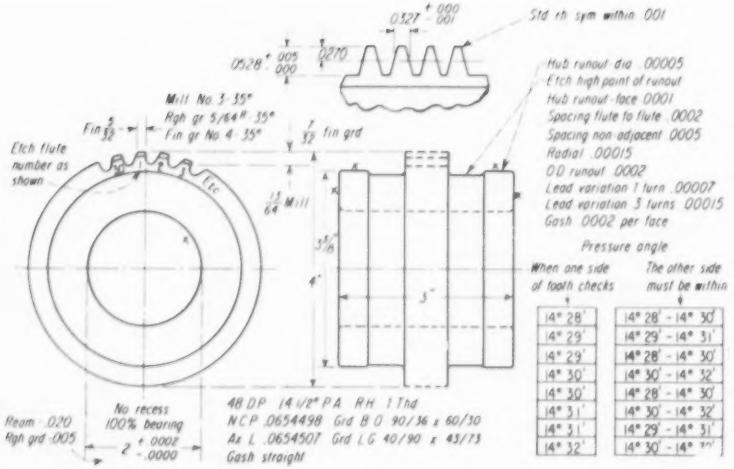
Further, equipment had to be able to break up this "non-adjacent error" into its elements, and research had to undertaken to discover the cumulative error of a series or train of gears, the effects of lubrication, deflection, loading, wear, finish and other operating conditions. Also, what happens to the gear in motion—high speeds in service would undoubtedly have effects, but these could only be determined by new forms of dynamic checking instruments.

This demanded entirely new measuring equipment, plus new designs for locating the blank on the machine and for holding it to its shaft in service. All elements, from design to final assembly, had to work together to "pick up millionths." And to pneumatic, electronic and mechanical gaging equipment, such optical devices as theodolites and auto-collimators had to be added.

With this work as a basis, discussions were begun with machine-tool makers again, resurveying all methods of generating or forming gears. It was obvious that a new design of machine would have to be developed. Some 100 sources were covered, but the only vendor willing to attempt to meet Sperry specs was Barber-Colman. Discussion and study led to the decision to try the job by hobbing—*with no further finishing like grinding or shaving*—Sperry to check the machine as required during construction, Barber-Colman to guarantee not the machine, *but its product*. Gears were to have teeth parallel to their axis of rotation, and a tooth-spacing error between any one tooth

Tooling is simple . . .

Blanks are held on column fixtures lapped to within 10 millionths of flatness and parallelism on both surfaces and bolted to the table. Here Elias ("Frank") Cusato loosens the nut over the fixture clamping plate to permit removal of a finished gear. The blank is indicated into position on its proof diameter within 10 millionths, then held by the nut, rather than being centered on a spindle. In fact, it is later indicated into position in the "brain box"



Hob doubles accuracy . . .

Although it looks like a standard hob, this one has half the error of the best previous one (Class AA), yet is approximately 2½ times the diameter of a standard hob of the same pitch. Class AA hobs of 30 DP and finer are permitted, for example, lead variation in one axial pitch of 0.00015 in., in three of 0.0003 in. This one has only 0.00007 in one, 0.00015 in three. Large diameter permits more teeth to finish gear tooth profiles; this, with low feed revolution, results in a very fine tooth finish. Wide hubs and a 2 in. bore provide maximum rigidity. The 30-flute hob is HSS T-1 select, bath hardened. After hardening, it is rough ground on all surfaces to remove scale, stabilized by aging and reheating, checked by Magnaflux, then finish-ground to tolerances. Note twin proofing diameters on hubs, also absence of a keyway. The latter provides greater stability and insures desired concentricity

and any other tooth not exceeding 10 sec of arc, measured on the gear-teeth involute profiles within full face width of teeth on any diameter between the gear outside diameter and the working-depth diameter. The two organizations were to cooperate in design and checking, each contributing results of research to the objective.

Machine specifications

Obviously, the "Ultracision" hobbing machine that resulted from this collaboration is only generally similar to previous hobbers—yet it was built in only 1½ years from contract to delivery. To hob gears which would transmit angular displacement within 10 seconds of rotational error, many unusual elements were incorporated, including the greatest care in manufacturing and assembling all parts. Many features appear insignificant in themselves, but all contribute to the cumulative accuracy.

Engineers and methods engineers from Sperry established these specifications: Maximum diameter of the gear blank is 10 in. Maximum length of hob-slide travel is 6 in. Maximum rated pitch capacity is 32 DP. Normally, a relatively small machine would be used to cut such fine-pitch gears. However, this machine weighs 11,000 lb, and with controls weighs 13,800 lb—considerably more than the No. 14-15 Barber-Colman hobber, which has a max rated pitch capacity of 3½ DP. The additional size and weight here provide the rigidity needed for the exceptional accuracy required.

Drives

Because the machine is designed to cut only spur gears, the feed-drive motor is independent of the main drive motor. Feed is provided by an adjustable-speed unit which provides a range of 0.001 to 0.300 ipm. It has a 100 to 1 ratio, and pickoff gears increase this to 300 to 1. Such a low feed rate is required because the machine must accommodate gears with as many as 640 teeth. At a hob speed of 50 rpm, a feed of 0.001 ipm will produce approximately 0.013 ipr when 640 teeth are being cut.

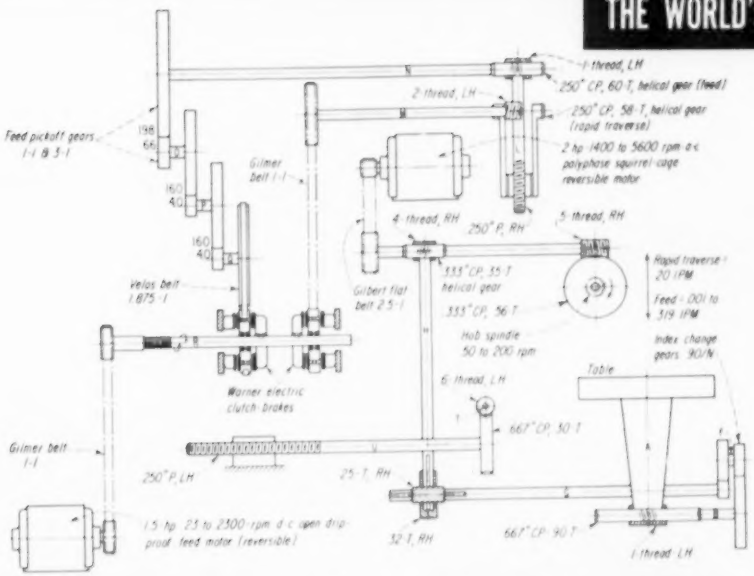
Work spindle

Accuracy of relative rotation between work spindle and hob spindle is an important feature. Obviously, accuracy of the hobbed gear could be no greater than accuracy of rotation of the index worm gear—in fact, it would probably be less because of other errors in machine and hob. Therefore, when the worm and worm gear were mounted in the table, Sperry engineers inspected rotation of the worm gear dynamically with reference to rotation of the hob spindle. Their final check showed that the worm gear was within the requirement—uniform angular displacement within 10 sec with reference to hob-spindle rotation. This was considered sufficiently accurate because other errors in machine and hob should not cause a total error of 10 seconds. The checking method is very interesting, so is detailed here.

How spindle accuracy was achieved

The work-spindle drive system is a unit separate from the rest of the frame and the head—built into its own surface plate, as it were, because top and all four side surfaces of the table base casting are scraped to within 0.0001 in. of flatness and perpendicularity.

The spindle drive is the critical unit, so was built first. When it was assembled, Sperry engineers went to Rockford to test it, devising a test method at that time which has since been used for checking the completed machine and for periodic rechecking. It has



Drive simplicity for rigidity

Except for the index change gears, the gear train between main driveshaft and index worm contains only a worm and worm gear and a pair of 90° helical gears. These two sets of gears allow only minimum vibration. The index change gears are spur gears finish-hobbed within a tolerance of 0.0005 in. total composite error. The hob drive worm is mounted directly on the main driveshaft. This single worm and worm-gear give maximum rigidity of hob spindle. There is no tie-in between index and feed, and no bevel gears or splines in the train

Relative index check . . .

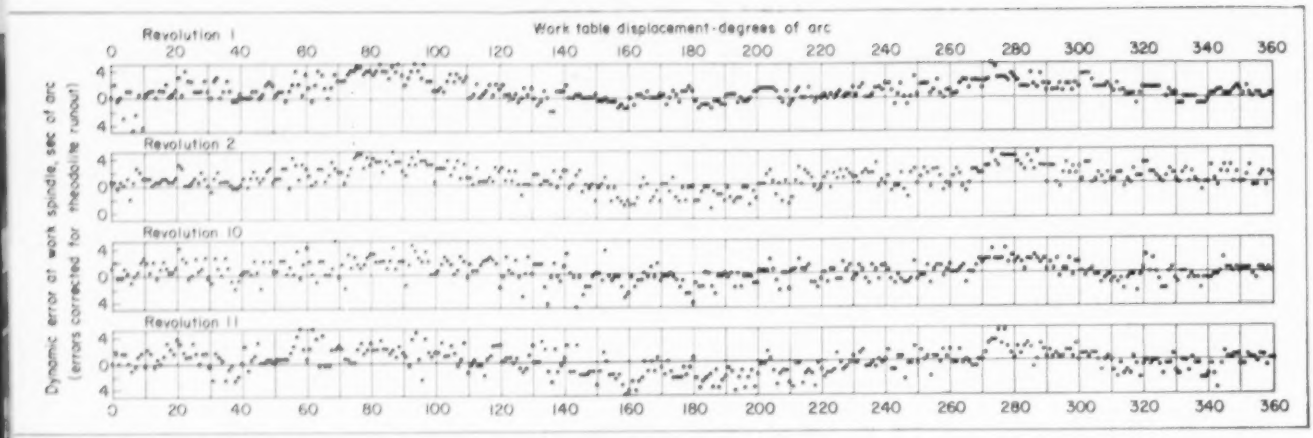
The spindle drive is housed in a separate normalized table block, so it can be removed from the hobber as a unit. All four sides and the top of this block were scraped to within 0.0001 in., so they can be used as a surface plate. Here Mr Ross checks relative indexing, with a Strobolume (on faceplate left) lighting theodolite (center) index scale so it can be photographed by movie camera at top. Strobolume power supply (being turned on by Mr. Ross) and electronic synchronizing unit are at right foreground. Impulses to fire Strobolume are delivered by a disk switch of Teflon with coin-silver slugs, indicated onto end of hob-drive spindle (closeup photo). Firing occurs at ¼-revolution intervals. Illumination occurs for only 20 microseconds, hence stops the theodolite scale within 100th of a graduation (line is 80 millionths in. wide). Table indexing was checked this way before the rest of the machine was built

proved accurate to the accuracy of the base instrument, a theodolite, which is 0.2 sec of arc—or 1/6,480,000 of a circle!

The theodolite is a Wild T3 with 360° scale. It is centered on the hobber spindle and clamped there, while its yoke is held from rotation by clamping it to a stanchion which is in turn leveled on and clamped to the table in place of the tailstock. To illuminate the theodolite scale through its own optical system, a General Radio Strobolume is taped to the theodolite mounting base. Lighting of the Strobolume and tripping of a camera shutter are initiated by a Teflon-disk commutator on the hob-spindle drive shaft. Coin-silver slugs spaced 90° apart provide the contact. Slug positions were established and checked with the theodolite.

Thus when the hob drive shaft is rotated 90°, the Strobolume will give a 20 micro-second flash, enough to permit the theodolite scale to be photographed so its comparable arc of rotation can be measured. Graduations on the scale are only 80 millionths of an inch wide, and this short flash stops it within 1/100th of a graduation, so provides very high accuracy.

The picture of the scale is taken by a Bolex H16 movie camera mounted vertically above the theodolite on the stanchion. Thus a permanent record is provided of the relationship between hob drive shaft and spindle rotation for every quarter turn of the shaft. The camera takes only single frames when the shutter is tripped by the Strobolume, film being indexed between shots by a cam after each exposure. Film is read with a microscope and the results charted; four charts are reproduced here.


Revolution 1
Work table displacement-degrees of arc
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
Revolution 2
Revolution 10
Revolution 11
Dynamic error at work spindle, sec of arc
(errors corrected for theodolite runout)
4
0
4

Here is the record . . .
Dynamic input-output errors between hob shaft and work spindle have been charted for many table revolutions. Here are four typical ones corrected for theodolite runout. All data are referenced to zero angle of revolution No. 1. Note that at no point in spindle revolution does error in relative rotation between work and hob spindles exceed 5 seconds of arc, and that it is commonly far less. Also note similarity of major pattern. Minor variations tend to disappear or level out as the spindle runs in

The first check of the drive system indicated accuracy was not sufficient, so it was reworked. The second check indicated indexing accuracy within 10 sec of arc, and subsequent checks after the machine was built and after it was installed have shown it retains this accuracy.

Machine frame

Once this unit was approved by Sperry engineers, Barber-Colman undertook building of the rest of the machine. Procedures like that in building the table were followed all the way through. The table casting, far heavier than usual, was rough-machined, normalized, cleaned repeatedly (to make sure no surface sand or other possible tiny particles were left to affect accuracy later), then finish-machined. The frame casting, or base, is also much heavier than usual. All construction and assembly was done in a special laboratory —on a special seismic block—by personnel of the Manufacturing Laboratory. Vital surfaces were scraped square and parallel to a true plane within 0.0001 in. per ft. This includes the table for accuracy in mounting tooling, the tailcenter bracket, and inspection equipment; the sides to provide accurate reference surfaces for manufacture and assembly. (Sides have now been painted for protection—they are not required for present checking.) The hob swivel is scraped for accurate movement of the hob spindle—all in all, more scraping than ever before done on such a machine. Even the covers were scraped to fit the scraped portions of the table casting to prevent leakage of oil or entry of any foreign material. Many parts, including ways, worm blanks, and some shafts, were normalized and deep-frozen at various stages of machining to relieve all stresses and strains that might cause a part to grow or distort after finishing and assembly.

Index worm and work spindle are mounted in ultra-precision tapered-roller bearings. Worm and worm gear run sealed in oil. The work spindle has a precision faceplate for mounting work or tooling directly to the spindle face. Work can also be mounted on an arbor between centers. The work arbor is adjustable so it can be adjusted for runout within a few millionths. The tail center is also adjustable so it will maintain the center of the work coincident with the centerline of the work spindle.

Except for index change gears, the gear train between main drive shaft and index worm contains only a worm and gear set and a pair of 90° helical gears. These two sets minimize vibration. Index-change gears are spur gears finished-hobbed within 0.0005 in. total composite error.

Center-to-center distance between shafts is set with precision gages and Jo blocks prior to mounting the change gears. Tapered bores in the gears and precision tapered-bore roller bearings for the intermediate stud are designed to minimize runout. Lubricating oil for the change gears is filtered to remove any particles of foreign matter that might affect rotation of the index worm.

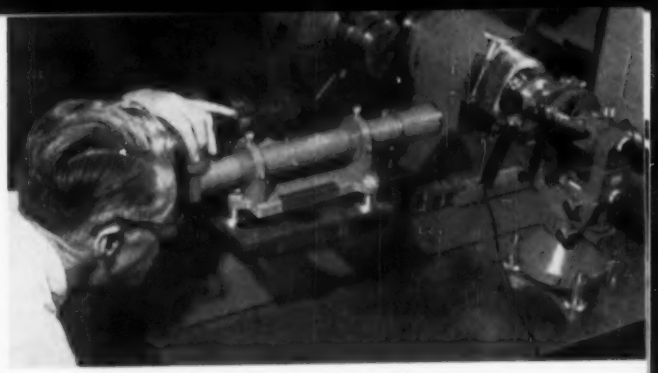
Hob spindle

The hob-drive worm is mounted directly on the main drive shaft, assuring maximum rigidity. For the same reason, there is no hob slide, the hob being mounted on a Scully-Jones Rolock 2-in. mechanical-expanding arbor with 0.0002-in. expansion (10% of standard). Thus the hob can be shifted on the arbor, rather than by a hob slide, and no keyway is necessary. Both hob spindle and outboard support are mounted in ultra-precision tapered roller bearings.

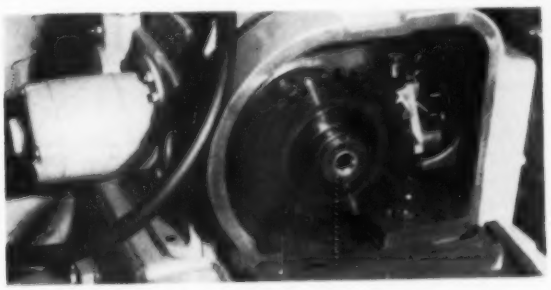
Precision rollers riding on hardened and ground V-ways carry the hob carriage. This eliminates any tendency of the carriage to twist or stick during feed. Center-distance adjusting ways are hardened and ground V's. The depth-adjusting mechanism has a dial and vernier graduated to 0.0001 in. There are no gibs or clamps on these motions because of the possible distortion they permit.

Coolant supply, from an outside source, is filtered to prevent chips or foreign particles from affecting tooth form or finish. Tests indicate that chips between hob and gear can cause errors in adjacent-tooth spacing as great as 5 sec of arc. Supply and return lines for coolant are flexible to avoid transmitting vibration.

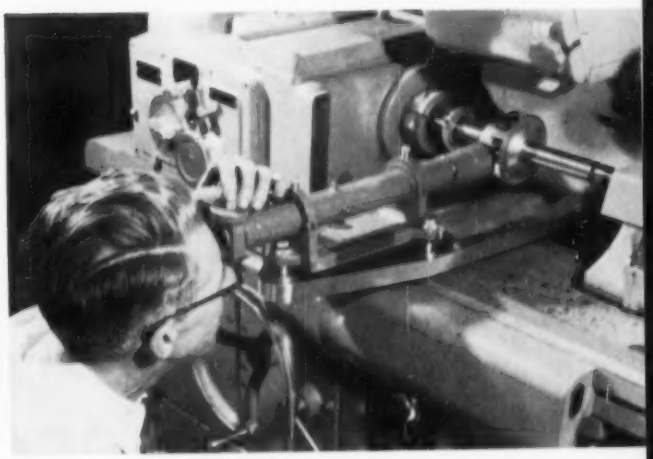
Auxiliaries are separate . . .
Even the belt-drive motors and control panel (center rear) are mounted off the seismic floor block on which the machine rests. The Kleenall cutting-oil filter (right) is also just off the periphery of the isolation block, and connected by a flexible-tube inlet and cantilevered return trough (with air space between machine and trough). For convenience, the block is covered by a suspended floor to within 1 in. of the machine



Mesh check . . .
Two ultraprecision gears in mesh are currently checked for functional errors with this setup. Senior Laboratory Technician Arthur B Cole uses the auto-collimator, a 30-sided polygonal mirror and the theodolite to measure output angle. Input angle is measured by a Moore dividing table built to special tolerances for Sperry at center rear



Hob resharpening . . .
Hobs are resharpened on a standard Barber-Colman hob sharpener reworked to hold flute spacing to 0.0001 in. and index accuracy to 2 sec. This meant that the pawl and index plate had to be fitted far more exactly. Here Mr Cole checks the indexing mechanism with auto-collimator and 30-sided



mirror. The closeup shows the special 30-tooth index plate and pawl used to insure accuracy and repeatability of index. Exact duplicates, reworked at the same time to the same accuracy, are used in the hob-checking fixture. This could be done because all hobs have 30 flutes

Controls

A pushbutton panel and stop dogs are provided for ease of operation. Infinitely adjustable feeds and speeds are controlled by selector switches. Pushbuttons give feed and rapid traverse in either direction (for climb or conventional hobbing). Stop dogs on the hob carriage control length of feed and rapid traverse.

The control panel is a separate unit which can be in another room if desired. It contains controls and interlocks to eliminate conflict of movements which might otherwise damage machine, hob, or gear blank.

Hob design

The hob is, of course, primarily responsible for the accuracy of gear-tooth profile, therefore must be exact if the gears are to be accurate. Only true involute profiles will transmit uniform angular velocity, so special "Ultracision" hobs were required. They are ground hobs, but are far more accurate than Class AA hobs (see drawing). They are much larger than comparable standard hobs, to provide more cutting edges and thus improve finish, and to permit 2-in. ID so the arbor can be larger and more rigid.

Many of the answers to problems in designing and making this hobber and hobs for it can be incorporated into future standard Barber-Column designs. The effect will thus be to raise the accuracy of gears which can be cut on standard hobbers with standard hobs.

Shipment

Sperry was responsible for the machine once it was outside Barber-Colman's doors. To avoid troubles that have spoiled accuracy of many machine tools in shipment, Sperry decided on very special handling. A dolly was constructed and mounted on under-inflated pneumatic-tired wheels. This was brought up to the assembly block, the hobber lifted carefully and placed on it, secured, and the whole business rolled out of the plant directly on to a motor truck. A protective shed was built over dolly and machine, and a Sperry man joined the driver in the cab for the 1000-mile trip from Rockford, Ill, to Great Neck, NY. Natural frequency of the truck plus load was held under a cycle a second to minimize transmission of damaging vibrations. Maximum speeds of 35 to 40 mph and avoidance of certain roads were further precautions against dam-

aging shock. Also, height of the load on the dolly made careful choice of route necessary to attain needed bridge and tunnel clearances.

Foundation

To support and isolate the hobber, Sperry provided a "seismic mount"—a 6 x 10-ft block of concrete 6 ft deep. The block, surrounded by a layer of cork, rests in the earth, clear of the building floor and foundations. Conditions are not perfect, because the plant is built on filled ground, a good low-frequency transmitter, and conduits in the ground nearby transmit such frequencies from plant equipment. Conditions are, however, sufficiently good for required accuracies. Into the block at the top are set two heavy I-beams to support the hobber. It rests on four steel blocks, each slightly larger than the foot it supports. Four ¾-in.-dia bolts tie the steel block to the beams, and center bolts hold the hobber to the blocks. There are no shims. The floor is brought to within an inch of the hobber base, but suspended so it touches no part of machine or foundation.

Gear blanks

Blanks, of a 416-type stainless, are rough-turned, stabilized by sub-zero cooling, then finish-machined, lapped on the back face, and finish-ground on the proof diameter. Present specifications call for concentricity within 0.000010 in. on proof diameter, but only 0.000030 in. has been attained thus far. Gears of steel, aluminum, and stainless may all be made on the hobber. Stainless is a common gear specification for Sperry trains, thus was selected for test and development.

What's Ahead?

Fabrication . . . Work thus far indicates that materials are a major problem. Homogeneity and hardness are not consistent. For example, hardness of 416 stainless around 240 Bhn is desirable, but raw stock has ranged from 102 up. Conferences with steel suppliers indicate it may be possible to obtain certified stock of guaranteed hardness and within a small tolerance of complete homogeneity.

The blank "pancake" is still not within required tolerances for roundness. Present best proof diameter is within 30 millionths, but 10 millionths is the objective. Manufacturing men feel this will be relatively easy, with more care all along the line. Among other things, IRD vibration analyzers will be installed on blank grinders.

Cutting techniques, cutting fluids, feeds and speeds have been developed by experiment and seem suitable thus far. Fluid and lube oil are continuously filtered in special filters, as shown. Fixtures have sufficient squareness and rigidity, and require only further familiarization to deliver desired accuracies.

There are, however, three remaining problems in fabrication. The first is blank centering, which still consumes too much time with close-tolerance indicating equipment. The need is for a rapid method accurate to one or two millionths; a mechanical-electrical instrument looks promising to measure with this accuracy.

Second among problems is cleaning the hob during cutting. Despite cutting fluid and an air blast, hob buildup occurs. Also, mechanical cleaning seems to be essential to maintain tolerances. The difference is a millionth or two, but all those millionths are important. Some form of brush cleaning suggests itself, but most brushes tested are either so soft they leave deposits that alter accuracy, or so hard they scratch tooth surfaces, again altering accuracy. Nylon brushes are thus far best, may eventually be the solution.

The third problem is deburring. Brushing is subject to the faults previously mentioned; mechanical deburring under a microscope is too costly, slow and inaccurate. Here again, there is a solution in sight: electrical-discharge deburring, using a tool mating with, but never quite touching, the work.

Inspection . . . Like setup, inspection is still far too slow, and presently available methods do not cover static and dynamic mesh, roundness to sufficient accuracy, nor do they permit rapid measurement of gear-involute geometry. Fixtures are coming for measuring dynamic errors on production gears, and the interferometric method, with counters, is being studied to speed production inspection. Taylor, Taylor & Hobson Talyrond equipment is on order. A new kind of measuring instrument, Sperry made, is under test, but not yet ready for description. It will separate geometric errors on gears up to 10 in. in diameter, with accuracy to ½ sec on any diameter.

Gear Train . . . Gear accuracy must of course be matched by that of the train, and many difficulties present themselves. The train must be as compact and as light as possible because space and weight are at a premium. But the mount must be rigid and stable under aging and shock. This is now the subject of a special study program.

Bearings and shafts can lose hard-won accuracy, too. The program already utilizes the 00 series—most accurate anti-friction bearings available—but may eventually be forced to close-tolerance sleeve bearings. Shafts of special steel, stabilized as are the gear blanks by sub-zero chilling and other treatments, have thus far been adequate. Gears are, however, flange-mounted and indicated in, an extremely slow process. Some faster mounting method of equivalent accuracy is advisable. Incidentally, difficulties with obtaining of solid bearing with tapered dowels in locating gears on flanges has led to use of straight dowels only.

Backlash may be a bugaboo, but isn't up to now. The whole program, of course, aims at avoiding such standard backlash-elimination methods as split gears and their high separating forces. Current planning is toward floating centers for all gears but one in the train, so gears can be loaded together. This holds separating forces down, but may create space problems in the increasingly small "'brain boxes."

Effects of wear and dynamic tooth deflection have been checked in preliminary studies, but must await completion of new test equipment for final analysis. Present indications are that neither will affect accuracy in the relatively short service life of many of these trains. (Missile trains, for example, must be exact—but only for one short run.)

To minimize future fabrication problems, all development work is being done on stainless-steel blanks. If these can be done successfully, steel, aluminum-alloy and brass should present no real problems. The real future headaches in this area will occur as a result of increasing pressure toward miniaturization—because every step toward a smaller "brain" or a smaller gear train means a whole new series of problems with materials and machining.

Bernard Haldane tells:

How to find success ...and people who will succeed

Here's an idea that sharpens the teeth in that old saw, "Nothing Succeeds Like Success," by proving time after time that the road to achievement is clearly defined — by previous accomplishments dating from childhood. "Success Pattern Technique" is based upon a simple principle, applicable by almost anyone. It provides a valuable management tool for personnel selection, task assignment, and many other important decisions. Most of all, it can help you find yourself.

WILLIAM M STOCKER, JR., associate editor

For many years companies have been told that the main reason people are dissatisfied in their work, and look elsewhere for employment, is "lack of recognition" from top management. Bernard Haldane, president of Executive Job Counselors, Inc, New York City, whose business is counseling some 5000 people each year who want to change their careers, says this just isn't true. Some months ago, he decided to survey the last 1000 people who came to him for guidance for the real reason they wanted to change. There were many reasons, but only one in 100 actually wrote, "he didn't get sufficient recognition." However, more of them wanted more money (another form of recognition) and a sizable number "really didn't know what they could do best." That last one is an important key. No one—not the person, his parents, his educators, or his previous employers—had ever bothered to find out.

If this survey is correct, (and it appears sound), much of the money spent on human relations and related training programs as a means to reduce job turnover is *just money down the drain*. Because a person's basic abilities so often determine his fondness for his work, training as a means of preventing job turnover benefits most the people least likely to leave. Training programs are highly important for furthering ability, and the company's objectives, but they are wasted on people who don't have the basic ability or interest in the first place. They won't keep those people from being dissatisfied.

Most people, perhaps even you, operate at less than 50% of their potential ability. Why? Because, primarily, many factors influence a person's decision to accept an assignment: money, prestige, location, availability, family influence, friendship, fear, hunger, and countless others. Frequently, one of the least-considered elements in making up one's mind is, "Will I enjoy the task?" Not knowing what he can do best, the person is at a loss to determine his chances for success.

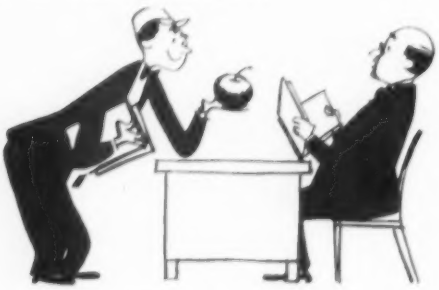
Once he has accepted his first job, the die is cast. If the person is among a fortunate few, his abilities and interests will match the task and he will find happiness and success. But this is surprisingly rare. Far more often a degree of discontent will creep into the person's attitude. It may show up in any one of many forms: frustration, boredom, nervous tension, temper, loss of interest. But these are all effects. The cause goes unrecognized. While many causes are possible, and blame is often misplaced, a lack of task compatibility is a major reason for discontent.

Depending upon the seriousness of the condition, a number of things can happen. You have seen examples of all of them. The employee may become submissive and stay with the job for the rest of his life, but always wondering why other people advance around him. For years the idea that "work can't be fun" (descended, perhaps, from the Puritan attitude that man is conceived in sin, hence shouldn't enjoy himself) has imprisoned people in unsuitable tasks.

On the other hand, and more commonly, the discontented employee will either resign or be fired. In either case he seeks employment in another place. His principal sources are company employment

"... e seeks employment in another place"

How to find success . . .



". . . every person has a Success Pattern"

offices, employment agencies, classified advertising, or associates.

"Classified" is the problem word. He has worked at a particular task, hence he is tagged. Wherever he goes for employment, the same question is asked, "What did you do in your last job?" Even when he looks through the "Help-Wanted" columns he seeks out his former job title. What else can he do? He doesn't know what he can do well, and, at least, he knows the requirements of the work he has done. He blames his previous discontent on the employer, his former "boss," poor incentive, fellow employees, or any one of many *effects*—but seldom the real *cause*.

Similarly, the person may be very good at the task he is doing. His company considers him a valuable employee. Still, he is discontented because the job does not permit him fully to express his abilities. He wants a position with more "future." Most of the time he winds up in the same task, for more money, at another company. His original employer will have lost a good man, he will waste a lot of the information of value to the employer, the cause of discontent still exists, and no one understands the problem.

Regardless of the reason for seeking new employment, most job seekers, because they are familiar with the task, will be given the tasks or jobs previously held. Thus the cycle is repated over and over again.

Employment services, almost without exception, hire people to fit a job description, basing their decision largely on previous experience, conditioned by education. Little effort is made to assign tasks to fit "success descriptions." Yet, how much better off both the individual and his employer would be if this were the criterion! While the personnel department is intended to work, primarily, with *people*, it too often concerns itself first with *tasks*. This is understandable because no better sytem has been available. Nevertheless, it continues to create serious personnel problems. What can be done to minimize discontent?

Every person has a "Success Pattern" (sometimes referred to as SP), although most people don't recognize it. From earliest childhood there is a pattern of accomplishment; of outstanding acts, interests, enjoyments, and endeavors. To prove this statement, study the lives of famous, successful people (or even infamous people). Things they did, while young, would have given a clue to the probable field of their success, if these things were properly interpreted. "Success" is found in doing what you feel brings you both financial and personal-happiness returns, which, in turn, gives you satisfaction with the course of your life.

There's no such thing as accidental success. Incidents which lead to success occur, consciously or unconsciously, on purpose. When they occur consciously, the success is likely to take place faster. Partial success results when only a fraction of the individual's inherent ability is utilized. Man exists to do *something;* to provide a service to Creation. If there is *any* purpose for every human being, getting something useful done is an expression of that purpose. And Man is happiest when he is providing the service for which he is best equipped mentally and physically; work that expresses his personality.

The problem of determining one's Success Pattern involves correct analysis, interpretation, and understanding of the dynamic factors within a person's experience. For example, a man may be a successful toolmaker, but that isn't enough information to work with. You must know the reasons for his success, such as manual dexterity, good spatial perception, neatness, inventiveness, and so on, any one or more of which might be contributing factors. But to envision what he might be good for beyond, or in addition to, toolmaking, you must go deeper than the simple fact of his present ability.

If all of the foregoing sounds peculiar to someone in a menial job, it isn't the fault of the logic. It's the oft-repeated chain of circumstances that sets the pace. No person is born to do work requiring less than a few percent of his facilities. Thus, techniques like "automation" are gradually taking the drudgery out of service. Each day the need for new services opens further chances for success. Also, Success Pattern Technique is one very valuable answer to the threat of technological unemployment. Not only does it make possible determination of new job possibilities for people displaced by automatic equipment, but it makes their new tasks more rewarding as well.

FOR EXECUTIVES TOO

We cannot always do all of the things we'd like to do, but we seldom do even half of the things we are capable of doing. There are many reasons for this, the most common one being that we don't know our own capabilities. Strangely enough, while we don't recognize them, these abilities make themselves felt in a sense of dissatisfaction when they are unused.

Discontent is not limited to the labor grades of work. In fact, it appears more frequently among executive groups than anywhere else. Typical of this is J P Marquand's "Point of No Return." What may appear to be success to others is not always considered success by the individual himself. Even top executives seek to change or broaden their careers, without knowing exactly what they can do about it.

On the opposite side of "success pattern" are the things in one's life that appear to be failures or were carefully avoided. These are destructive. Often they

resulted from criticism of something enjoyed or cherished, family attitudes, a painful experience, embarrassment, lack of interest, early misdirection, and many other problems. These things tend to constrain the abilities. Most people underestimate their abilities, lack confidence in themselves. They are excessively self-critical.

In developing an individual's success pattern, failures (real or implied) are disregarded. They add nothing constructive to the prospects of success. It is understandable that a person will fail at tasks his basic skills can't accomplish, or his mental attitude, conditioned by criticism, won't accept. This doesn't mean that he cannot use the skills he has, or cure his attitude, to succeed. Hence, only successes point the path to success. Failures, when properly interpreted, can show only wandering from the path.

One of the nicer things about the success-pattern technique is that, to a degree, anyone can use it. Only common sense and a little practice are necessary to develop an individual's general success pattern. Detailed interpretation requires more expert training. However, except for very general direction, it is difficult for a person to develop a pattern for himself. Too much self-criticism enters into the analysis. Mr Haldane says that the pattern will be more reliable if someone else does *your* analysis and interpretation. This also applies, to a lesser degree, to your immediate family. By using this SP technique, an employment service, or the manager of a business, can interview a job applicant to discover his real chances for success in an assigned task, or the basic skills and interests which will make him valuable in another capacity.

For example, a machinery salesman was doing a very satisfactory job for a local dealer in a position that allowed him to go home every evening. He wanted more money and felt that he could earn it in another firm. He received an offer that meant more money but required extensive traveling. Would he be successful in the new task? During the interview everything pointed to his outstanding sales skill. However, when he was asked what he considered his most recent important accomplishment, he replied, "Well, my son, I guess. You see I have a six-year-old son, and my wife and I delight in teaching him new things, in taking him places, in watching him develop. He really learns fast."

"... failures ... are destructive"

"... he wanted to be close to his family"

This man had outstanding sales ability and an incentive to succeed, but his chances of finding real success in a job that kept him on the road for weeks at a time were very slim. He wanted to be close to his family, and homesickness wouldn't help his sales record. Yet even he didn't recognize the pitfall. The answer: Give him a local sales job where incentive for his effort would increase his earnings.

In essence, it is the common-sense approach that pays off. Without any special aptitude tests or psychological examinations, the answers to some seemingly routine questions can provide a remarkable amount of information. Some of the questions might be asked in a conventional interview. The major contribution is in the organization and selection of questions specifically designed to develop a pattern of information—and a basis for more detailed probing. Furthermore, the interview is entirely constructive and beneficial to the interviewee, hence there is little chance for embarrassment or conflict of interest.

Here is the group of ten primary questions which, when asked by a trained interviewer, will bring forth information that can be interpreted in great detail. When asked by an executive or someone else in a hiring capacity, the answers usually will give sufficient information to permit him to select the right man for the right position—and certainly will insure his non-consideration of the wrong person:

1. Describe briefly your most recent achievement.
2. What are your most active hobbies?
3. To which hobbies would you prefer to give the most time?
4. Which were your *best* subjects in grade school? In high school?
5. Which three subjects did you most *like* (in order)?
6. Let your mind go back, back to earliest childhood. What is the earliest achievement you can recall—perhaps before you were five?
7. Please describe briefly two or three more early-life achievements—perhaps things that happened before you reached age 10.
8. Now can you describe two or three outstanding achievements before you were 15? What made them outstanding?
9. What do you consider your outstanding achievements while in college, first job, or both?
10. What do you consider your three greatest

How to find success . . .

achievements? (Indicate the order: 1st, 2nd, and 3rd.)

As each of these questions is answered, the interviewer should note the replies on a sheet of paper. He will quickly become aware of a "direction" developing on the paper, a pattern of skills and interests. This "success pattern," with a little analysis, will show the basic abilities and personality of the person interviewed. If no pattern develops, this too is an indication, but it is likely to be beyond the training and ability of the interviewer properly to interpret the reason. However, no pattern is rare.

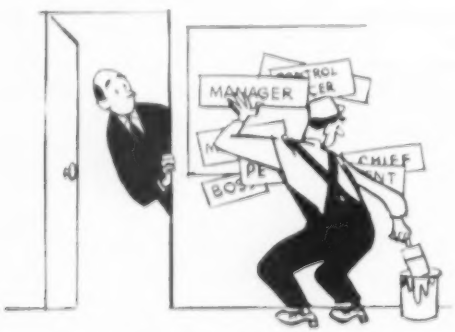
Among the many reasons for lack of a pattern is poor basic interviewing, with the purpose poorly explained, rushing the questions, etc. In an actual case, the interviewee showed broad interests but no pattern. Further questioning brought out that this person was extremely intelligent; had been first in every class throughout high school and college; was a leader in many activities. Special analysis was necessary to develop the true pattern. Also, in other cases, there may be many psychological reasons for a scrambled picture. These aren't necessarily bad, but amateurs should not attempt to find the answer. If appropriate, suggest professional advice.

How do you recognize a pattern? Let's look at an example. An employee is interviewed after three months in his new position. He says he enjoys the work but feels that he is somewhat confined in his duties. As the SP interview progresses, the interviewee states that his most recent achievement was convincing Management at his plant to install a new inventory-control system.

During his college life, he won a history award and was captain of the football team. In high school, his best subject was mathematics but his favorite subject was social science. He enjoyed athletics. Before he was fifteen he had started a newpaper route and had made it the most profitable in the community. At age four he knew the names of all of the animals in the zoo. His hobbies are reading history, golf, and "travel to see new places."

For greatest achievements he lists, without hesitation, recent promotion to Purchasing Agent, winning his wife, and election to football captain.

What does all of this information point to? At first glance, you may think that no pattern exists. Yet it is very clear. What does each of these achievements suggest as a basic trait?



". . . you don't know your own worth"

Election, promotion, and building a business mean *leadership, recognition by others,* and the *ability to gain the confidence of others.*

Knowing names, captaining, social science, history, and travel indicate a *social consciousness.*

Interest in active sports suggests *action* and *outdoor movement.*

Convincing Management, establishing newspaper route, and being captain of a team shows ability to *think things through, plan and persuade.*

Being good at mathematics suggests *precise thinking,* an *ability to see relationships, sense of system, analytical talent—ability to "figure things out."*

Desire to travel relates to his *concern with outdoors.* (Don't confine him to a desk.)

Success in purchasing requires an *awareness of values, figuring ability, ability to sell ideas, plus a talent for organizing, planning, and forecasting activities; intuition.*

Thus, in a few minutes of interview, you have brought out this person's basic aptitudes. Actually, this is only a brief study. Much more help and information would come from a more detailed interview. Nevertheless, it is clear why this man enjoys his work. He has most of the basic skills for it. However, Purchasing Agent *is* too confining for him. Both the man and his company might benefit if he was given a job in *market development* as a first step toward selling and then sales management.

FIND ENGINEERING TALENT

Here's a thought for the companies suffering from the shortage of engineers. Divide your engineering requirements into specific subjects and skills, then use success pattern interviews to find people with these skills among your non-engineer technical and semi-technical personnel, and applicants. Give these people specialized training if necessary. You will create technicians to supplement your engineers.

You probably are no different from the great majority of men and women with management or professional abilities—you don't know your own worth. Most people think it is enough to know their own talents, but this is wrong. In addition to knowing your talents, you must know how to use them best, and both the direction and rate of your development. The ten questions listed earlier are designed to show your talents, direction, and rate.

Only you can make this idea useful to you. Hence, take one hour soon and answer each of the questions, giving careful thought to each answer. Compare the pattern of your accomplishments with the requirements of your present position. What abilities can you contribute to further the success of your job and your company? Which of your present tasks should you assign to someone else?

Broaden your interviewing experience by developing Success Patterns for your friends and employees. Try this technique next time you interview someone for a new position. Remember it when you are faced with an employee who "just doesn't fit in." Use SP to promote from within. Think about his future, and yours, when you "classify" the "first-job" employee.

Excessive oxidation . . .
. . . on threads of the Series 300 stainless shaft was noticed after beryllium-copper impeller was investment-cast around shaft. Improper spin characteristics of subassembly was a result of very poor fit of oxidized threads. Better impeller was obtained by machining shaft from AISI 4130 steel, chasing instead of grinding threads, then chrome diffusing thread surfaces. When beryllium-copper impeller later was investment cast around threads on shaft, no oxidation or dimensional changes could be found on threads, and impeller assembly proved acceptable

Chrome diffusion improves both tools and parts

GEORGE H JACKSON & JOSEPH R BURNS, Manufacturing Research & Development Group
Production Engineering Department, BELL AIRCRAFT CORPORATION

Tests made by manufacturing research engineers at Bell Aircraft's Wheatland Plant have shown that a chromium case diffused into the surfaces of ferrous metals and stainless steels by gaseous diffusion is, in many cases, superior for surface protection to conventional plating.

In the chrome-diffusion process, on which patents are held by the Chrome Alloy Corp, chromium is alloyed at the surface of the part or tool by reduction between a gaseous chromium compound and iron. Iron atoms are exchanged for chromium.

Parts to be treated are packed in a crucible with the chromium compound, an energizer, and inert material. The crucible is then heated in a controlled-atmosphere furnace for a predetermined time between 1650 and 2100F, depending on material treated and properties desired.

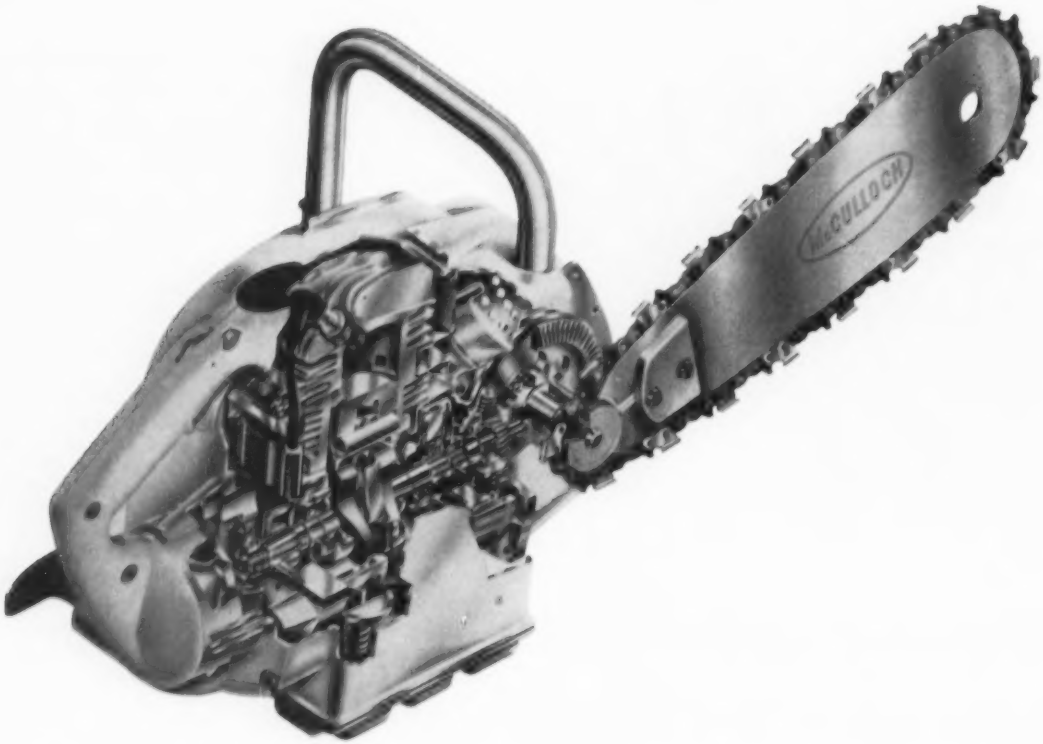
Surface of the part is transformed into either a high-chrome stainless or a chromium-carbide skin, depending on the composition of the base metal and the treatment selected.

Two methods are used—one for average corrosion resistance, the other for high wear and abrasion resistance. Hardness developed by the latter process ranges in the upper 70s on the Rockwell C scale. It also is important to note that complete conversion of the base metal to a chromium alloy is obtained in thin sections.

Bell Aircraft's Manufacturing Research Group has found that wear life of drills, reamers, and similar tools is increased by at least 25 to 50% by chrome-diffusion hardening. In one case, drills which had averaged 2 to 4 pieces per grind before treatment produced 10 to 12 pieces after chrome-diffusion.

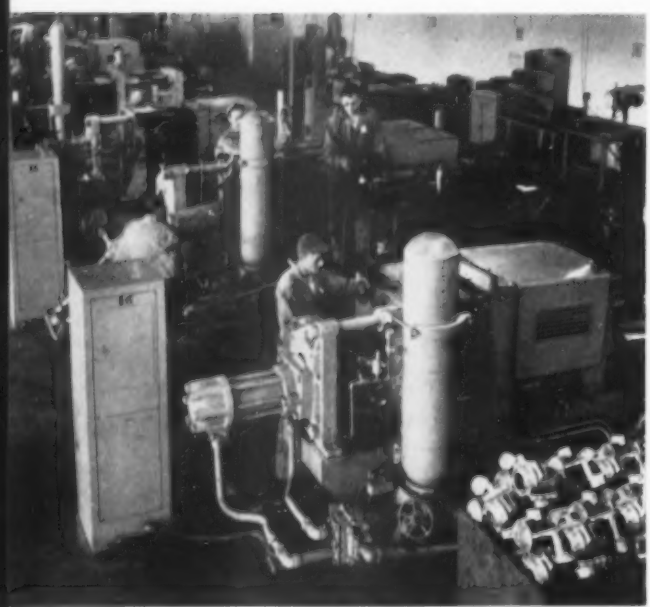
Tests on numerous aircraft and guided-missile components have shown that the process:

1. Improves the oxidation, wear, and corrosion resistance of low carbon, easy-to-machine steels, as well as of many alloy steels.
2. Increases the wear resistance of cast irons and tool steels.
3. In many cases can reduce material cost by eliminating the need for highly alloyed steels.
4. Minimizes heat-treating costs by replacing one or more expensive heat-treatments with one chromizing operation, which includes heat-treatment.
5. Reduces fabrication costs by permitting substitution of easy-to-machine low-carbon steels for alloy steels.
6. Conserves critical alloying materials.
7. Improves the appearance of ferrous metals.
8. Provides good corrosion resistance when parts are tested by immersion in white and red fuming nitric acid at both ambient and elevated temperatures (160 F) for 30 days.
9. Showed satisfactory resistance to shock tests after parts were immersed in liquid nitrogen once an hour for two weeks. There was no indication of checking or "crowfooting" after shock testing.

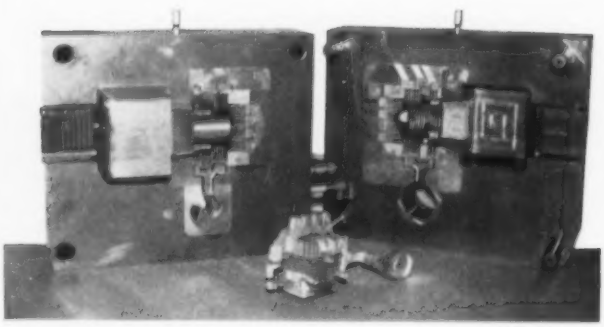


Packaged power in production

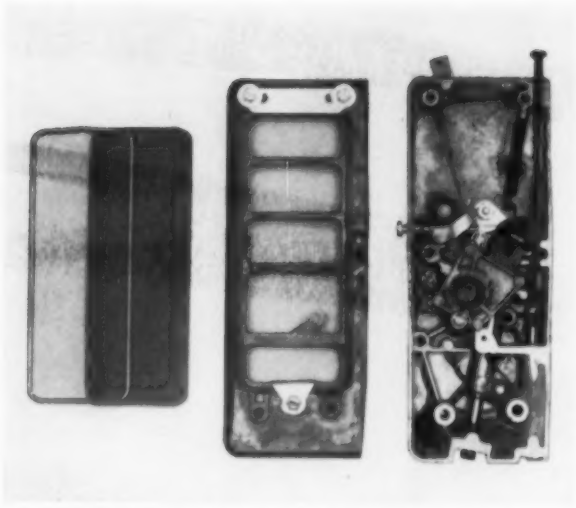
E J TANGERMAN executive editor



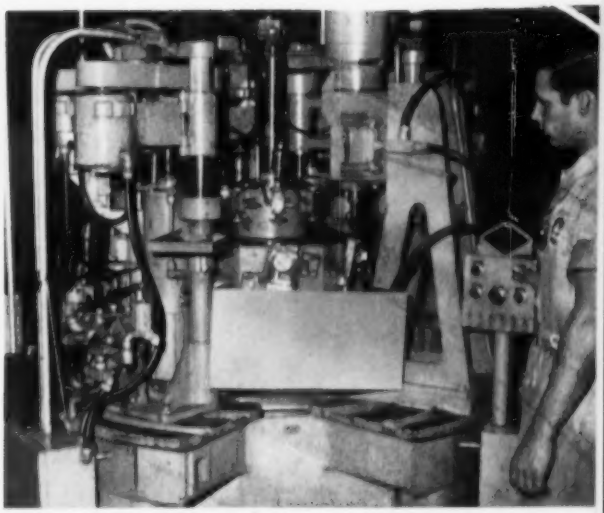
A LARGE PRODUCER of Mg and Al die castings, McCulloch has 15 machines modified to obtain up to 2000-psi line pressure—double the usual. This provides shot-cylinder speeds up to 10,000 ipm for magnesium. Locking pressures go as high as 600 tons. Annual production is 2½ million magnesium, and 1½ million aluminum, die castings averaging half a pound apiece. Four makes of machine are in this general view: Reed-Prentice, Cleveland, Lake Erie, and Lester-Phoenix



TYPICAL DIE CASTING is the 4-30 cylinder, here shown with the 1300-lb, $15,000 die that makes it. The cylinder is a challenging job in aluminum because of the deep fins and the CI liner cast in place. Production rate on this 2-lb, 3½-oz, piece is 40 per hour

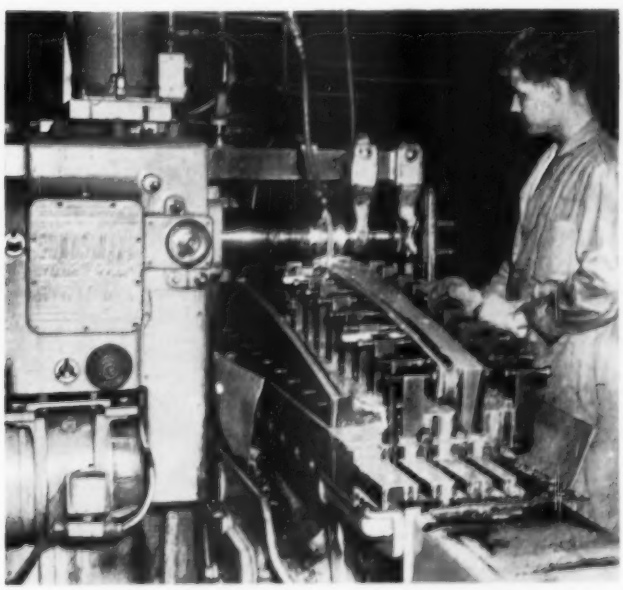


BETWEEN CRANKCASE AND CYLINDER on the Model 33 chain-saw motor is a pie-shaped space. Designers were asked to design the carburetor to fit it. Here it is. The air-filter screen at left is made in one operation, fits inside the diecast cover (center) completed in nine operations. The diecast body (right) requires 33 operations to complete

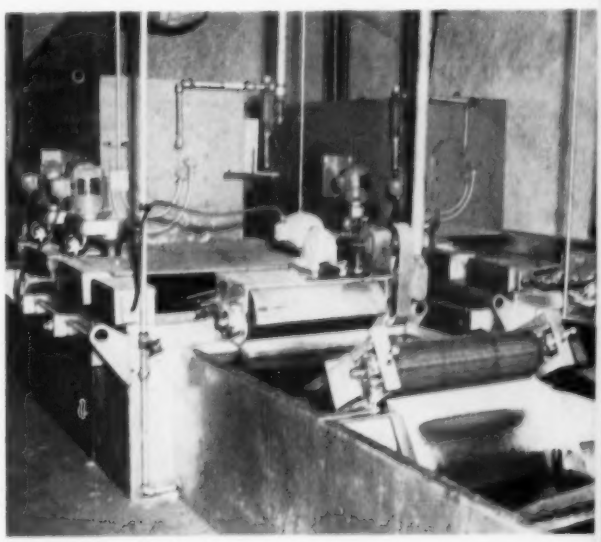


SIX OPERATIONS on the carburetor body are done in this Kingsbury six-station rotary, three drilling, two reaming, and one tapping. Capacity is 92 pc/hr. Note that this special machine is designed for adjustment in case of model change

Five years ago, McCulloch Motors Corporation built a new single-story plant in Los Angeles, where gasoline-powered chain saws, drone engines (for target aircraft), and other parts are built. Output of chain saws alone hits several hundred per day. The plant is largely integral, with its own plating (mostly stop-off for carburizing), heat-treating, presswork, and machining. It is also a showplace, embodying latest ideas in lighting, locker rooms with special air circulation to lockers, and the like. Here are typical operations.



BLADES which support the cutting chain are subjected to rough treatment in the woods, anything from striking to prying. They are as a consequence of top-quality steel, hardened and carbide-faced along the edge chain-slot, more ductile at center. Here the edge slot is milled, four blades at a time, in a Sundstrand Rigidmil. The slot is 0.350 in. deep, held to ±0.001 for depth, ±0.004 for position, and ±0.002 for width. The fixture has a cam at its inner edge which controls table height. Output is 28 pc/hr for 12-in. blades, to 7½ pc/hr for 60-in. blades. Slabbing is done in the same fixture



CHAIN PARTS, formed in presses, must be heat-treated to withstand speed and cutting loads. These two Pacific Scientific shaker-hearth Austempering furnaces can handle 300 lb/hr apiece under very close temperature control. Parts, of 0.80-carbon steel, are heated to 1550 F in neutral atmosphere, automatically quenched in salts at 560 F, then carried by chain-link conveyor to the warm-water tank for salt removal and finally to a tank of rust preventive. Parts are hardened to R$_C$ 51-54, with maximum ductility

CONTINUED ON NEXT PAGE

Major Machining is Done on Transfer Lines

MACHINES are tooled to produce 114 pieces per hour. Die cast in aluminum to close tolerances, the casting is lapped to provide the base reference surface, then drilled and tapped (36 operations) in this rotating-fixture special drill

CRANKCASES are light structures. To prevent flexing and distortion under clamping loads, and to provide exact indexing in each machine, each crankcase is held by four screws to a steel transfer plate on which it rides through the line. Plates are mounted in an automatic screwdriver at 116 pc/hr

CASES, on their bases, move along roller conveyors. Here, for example, is a Delta drill that does 15 drilling operations and a face-milling operation at 116 pc/hr

WHERE POSSIBLE, one man handles two machines. Here a pair of Heald Bore-Matics rough and finish bore the case. This machine bores three holes, faces a surface, and chamfers two holes at 36 pc/hr. Note the part is still on its transfer plate, located by dowel holes and automatically clamped

Round Table

Tail-End Charlie

"Ed, I have to promote somebody in my department to group leader, and I'm stuck with a problem. By rights, Charlie Jones should get it, because of seniority; but the rules say I should give it to Bob Handee because Charlie has such a lousy attendance and on-time record. What should I do?"

"What's to choose between Charlie and Bob for ability, Al?"

"They're both pretty good men, Ed. The only edge Charlie has is more time on the job."

"Then you've got a clear-cut answer, Al. Everyone who works here knows attendance and being on time to work is part of what makes a good record. Charlie can't kick if you pass him over and pick Bob."

"But he's *going* to kick, Ed. I understand he's planning to see the grievance committee if I announce Bob for the job. How would it stack up there?"

"Like I said, Al; being on time and getting here every day is part of the job. It's written in the plant rules, so it's the law. I don't see how Charlie can possibly get any satisfaction. It's his tough luck, but he deserves it for not getting here all the time—and on time."

"I don't know, Ed. Seniority always has been an important factor. The grievance committee just might consider it more important than attendance."

"How can they, Al? If the guy's not here, he can't very well lead a group. And if he's worked here a long time, that doesn't necessarily mean he's worth a hill of beans as a group leader."

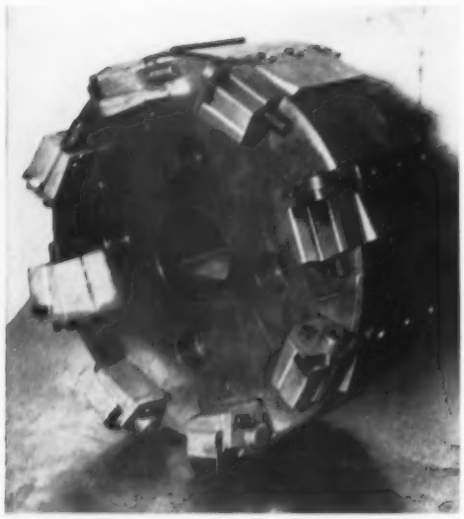
"Yeah; but he claims he was never warned about it."

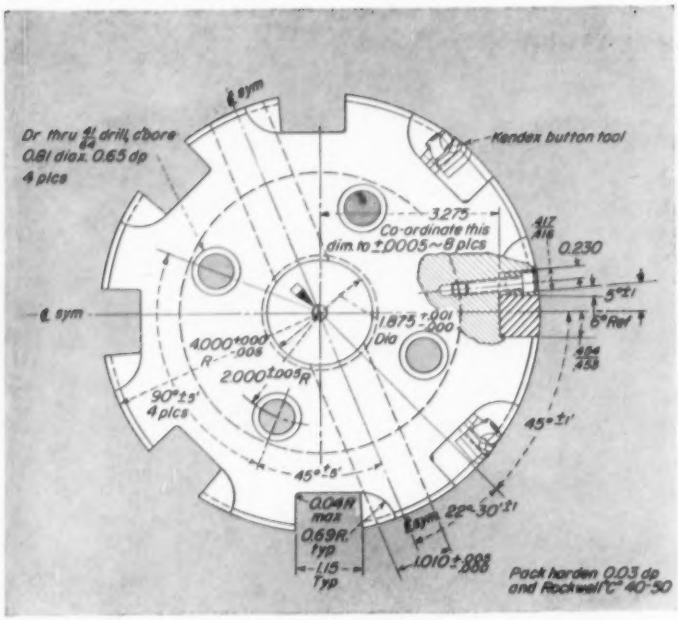
"Tell him to shove it, Al. It's right there in the company handbook. If he never read it, it wasn't because he didn't get a handbook."

"It's a touchy situation, Ed. I guess I'll promote Handee; but I'll bet I get into trouble. It's pretty severe—denying a man a promotion only because of attendance."

"And it's pretty severe if a machinist ruins a thousand-dollar casting just because the group leader is too lazy to come to work and help out."

***SHOULD** a man be denied a promotion solely because of being late and out of work often? Does poor attendance indicate, by itself, a lack of interest in the job? Your opinions may help others. Discussions of earlier topics start on page 239*

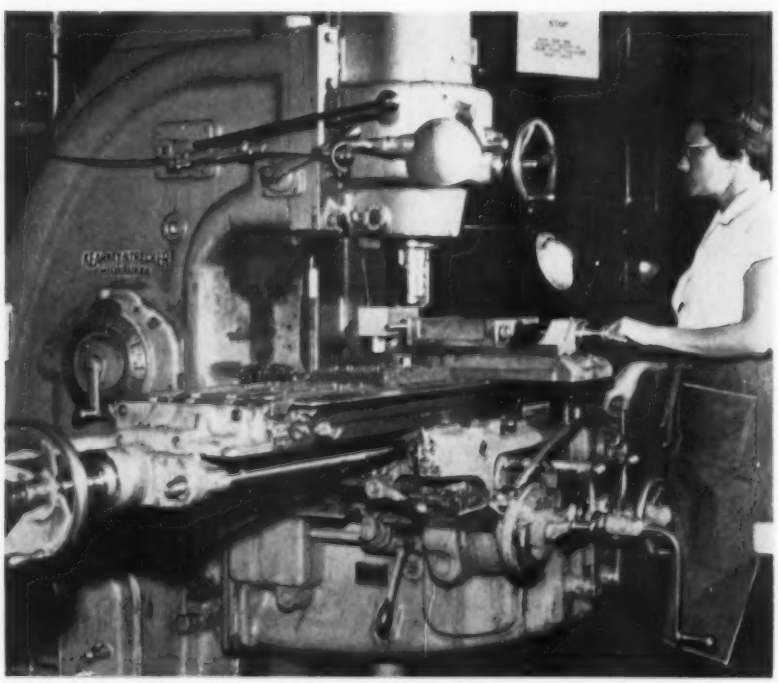




This 8-tooth, 8-in.-dia cutter is the result of a test program on the 2-tooth end mill shown in succeeding illustrations. Like its 2-bit counterpart, it has already given better finishes and shown the other advantages listed below. Three screws hold each toolholder for tight

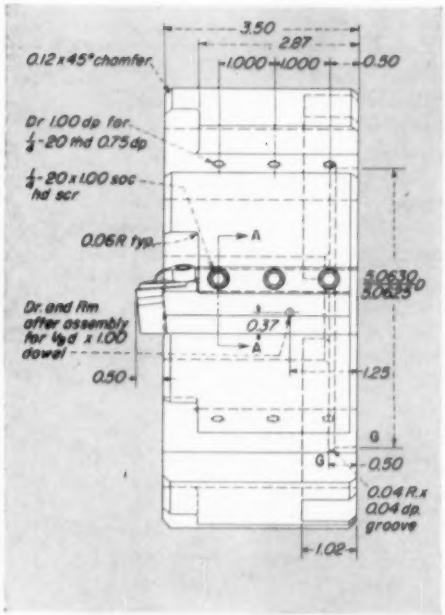
NEW CUTTER TYPE EMERGES AS...

Convair tests a throwaway-insert



HERE'S THE TEST SETUP...

SAE 4130 steel, at R. 32, is machined at 350 sfpm with a 2-blade face mill having throwaway carbide inserts. Surface finish was 40 mu in. Precision-ground bits (rather than the utility grade) were found necessary to insure tooth alignment and avoid overloading

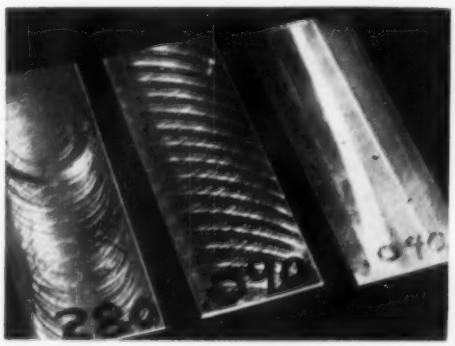


ness vital in this design. A cutter with brazed-in holders instead is being supplied by Vascoloy-Ramet

face mill

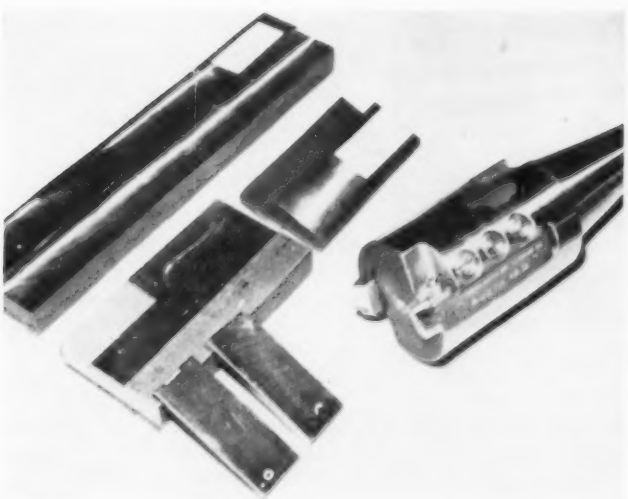
HERE ARE TEN ADVANTAGES...

1. Machine downtime is reduced because cutting edges can be rotated in seconds without removing the cutter from the machine or disturbing the setup.
2. Carbide grade can be changed as required by replacement.
3. Nose radius on bit can be changed as desired by replacement.
4. Cutter is rigid, so chatter does not occur.
5. Cutter is heavy, acting as its own flywheel.
6. Higher speeds and feeds may be used.
7. Tool service is done by operator rather than setup man, avoiding time losses.
8. Tool failures from brazing-heat checks and grinding cracks do not occur.
9. Cutting edges have correct rake angle and clearance.
10. Grinding-room load is reduced, saving labor, grinders, and diamond wheels.



SURFACE FINISH IS BETTER...

With conventional cutters, surface finishes of 90 to 280 mu in. were obtained, with a decided surface pattern. The new mill slashed this to 40 on steel, as at right. Part of the answer may be ease of exact bit alignment of the throwaway insert



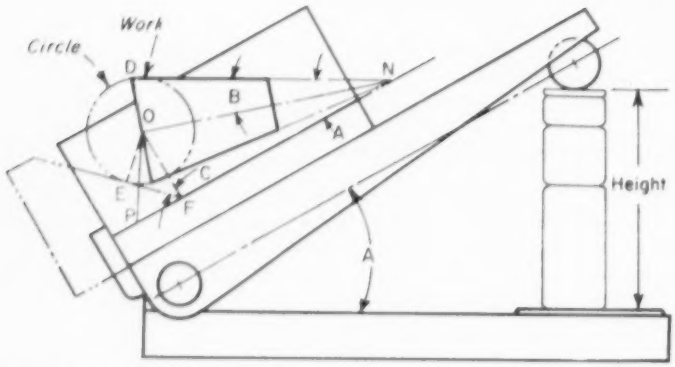
HERE'S THE CUTTER AND WORK...

Two square throwaway inserts, in Kennametal KBR 12 holders, were each held by three screws in the 4-in.-dia cutter at right. The large piece at left center is RC-1308 titanium alloy, the others SAE 4130 heat-treated to 182,000 psi tensile. On the titanium, surface finish was 20 mu in., on the steel 50. All cuts were made dry

NEW EDGES IN 15 SECONDS...

Bits can be replaced or rotated in about 15 sec per insert, without removing the tool from the machine. If negative rake is used, each bit gives eight cutting edges; with positive rake four. Similarly, on the larger cutter at top of page, triangular bits six or three

Practical Ideas . . .



Find Taper Angles With V-Block and Sine Bar

If you are inspecting or checking only one or a few parts, and cannot afford a special gaging setup, this method can be used for accurately checking a machined taper.

Mount the work in a V-block, then set up the block on a sine bar, as illustrated. Adjust the sine bar until the top of the work is horizontal, and build up gage blocks to get the height of the bar. This dimension, with the length of sine bar, will enable you to find the angle A; height divided by length being the sine of the angle.

Now make a sketch of the setup, including a circle centered at the end of the work and tangent at D. OF is perpendicular to the sine bar; OP is vertical, and angle OFE is half the included angle of the V-block.

Cotangent angle B is DN divided by DO.

$$\text{Tan A} = \frac{\text{DO} + \text{OP}}{\text{DN}}, \text{ so DN} = \text{DO Cot A} + \text{OP Cot A}$$

$$\text{Cos A} = \frac{\text{OF}}{\text{OP}}, \text{ so OP} = \frac{\text{OF}}{\text{Sec A}}$$

$$\text{Sin C} = \frac{\text{OE}}{\text{OF}} = \frac{\text{DO}}{\text{OF}}$$

so OF = DO Csc C
OP = DO Csc C Sec A
DN = DO Cot A + DO Csc C Sec A Cot A
Cot B = Cot A + Csc C Csc A

In the simple case, where the V-block angle is 90°,

Cot B = Cot A + $\sqrt{2}$ Csc A

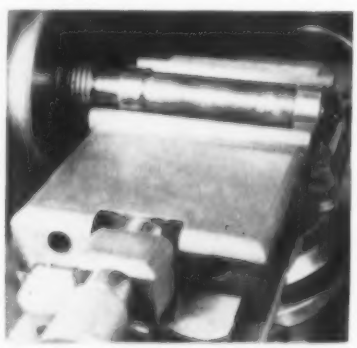
If you should already know B, and want to find height H, find angle A:

$$\text{Sin (A–B)} = \frac{\text{OF}}{\text{ON}} = \frac{\text{DO (or EO)}}{\text{ON}} \times \text{Csc C}$$

$$\text{ON} = \frac{\text{OD}}{\text{Sin B}}$$

$$\therefore \text{Sin (A–B)} = \frac{\text{OD Csc C Sin B}}{\text{OD}} = \text{Csc C Sin B}$$

Charles Minaire, St Etienne, France



Alignment Bar For Miller Vise

The time-honored method of aligning a swivel-base vise with the arbor of a milling machine is with a dial indicator. This takes time; here's a quicker way:

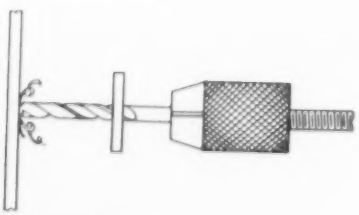
A simple alignment bar, tool steel hardened to R_c 60, is ground between centers and tapered on the shank to fit the miller. To allow fitting it to other machines, an additional adapting arbor can be made or a standard adaptor purchased.

The bar is located in the miller spindle, the vise released so it will swivel, and the miller table raised until the bar contacts the vise jaws. Actually, you want to align the permanent jaw of the vise, so the table may be raised, then brought in from the side until the bar touches the face of the jaw. Then the vise is clamped.

The gaging diameters of the bar must be equal in dia, and the bar

must be accurately ground. If so, this method is as accurate as the dial-indicator system.

H J Gerber, Oklahoma A & M Stillwater, Okla



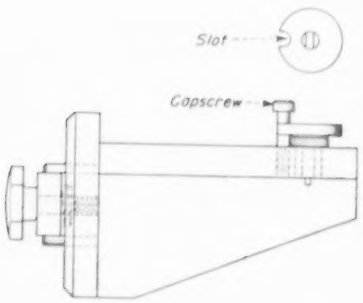
Tell-Tale Ring Guides Portable Drill

When you are drilling into the side of a casting or any other workpiece with a portable drill, you can keep the drill fairly close to perpendicular by eye from above.

Add a loose-fitting washer or metal ring, as shown, so it will ride on the drill itself. This helps you keep the drill aligned in the vertical plane.

If the drill is up at the rear, the ring will rotate and slide toward the work. If down at the rear, it will slide away from the work.

Michael P Blake, Rugby, England

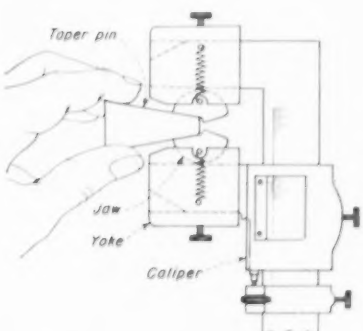


Economical Method Keeps Pins Aligned

This section of a spotwelding fixture illustrates a simple location pin, held in place by a capscrew. This method of locating and holding is inexpensive; it eliminates internal slots.

The pins can be rectangular or diamond shaped, and are used to locate assemblies or parts thereof in the fixture. To prevent the pins from falling out and getting lost, the screws are assembled so their heads cover the edges of the thumbnuts attached to the pins proper. The slot in each thumbnut admits the shank of the screw.

Stuart E Wadsworth, Homer, N Y



Caliper Attachments Check Odd Shapes

Rocker jaws fitted to yokes that fit over caliper jaws can be made up any time to inspect parts such as taper pins or similar odd-shaped pieces. The yokes can be made standard—both the same—to accept a number of jaw sets for different workpieces.

For taper pins, the jaws are cut to admit the pin only so far—because of the shoulders. At this depth, the caliper should read a given dimension. If not, the workpiece is off size. Some other method is used to check the taper angle.

Other jaw shapes might include similar pieces with shoulders at different locations, or with different contours.

John Dernoga, Rochester, N. Y.

Why Not Reversible Grinder Spindles?

All cutter and tool grinders run in one direction only, to prevent the wheels from coming loose. But—

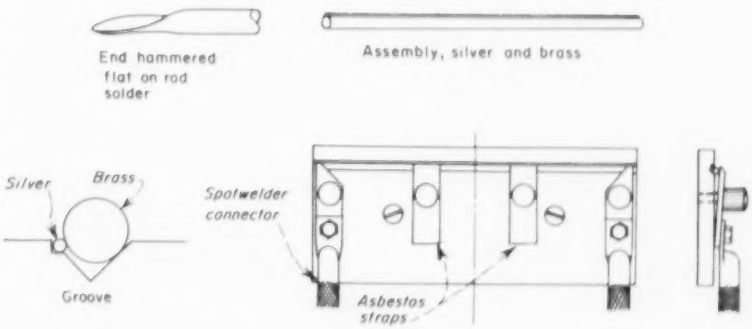
We find that wheels last longer when we reverse rotation often during a job. Evidently the cutting grains *can* work in either direction, although they aren't normally run that way. Both the heel and toe of each grain could thus be utilized.

When removing heavy stock, you usually run the wheel toward the edge of the work; yet it is good practice to finish up the edge itself away from the edge—eliminating the burr and drawing the heat away from the edge.

When different cutters are being ground, you can change setup easier if wheel direction can be changed. Only minor adjustments to the tooth rest may be required, instead of complete reassembly.

We replace the plain- and left-hand wheel nuts with safety locknuts, and there is no danger from wheels flying loose.

H Landauer, Tampa, Fla



Spotwelder-Powered Heater Solders Silver to Brass

This assembly is made with thin silver rod and thicker nickeled-brass stock, and must be soldered all along the interface. When we did it by regular hand torch, we used an aluminum fixture, which was later changed to steel because of heat damage. Even this didn't work well, because it required slow setup with thin solder.

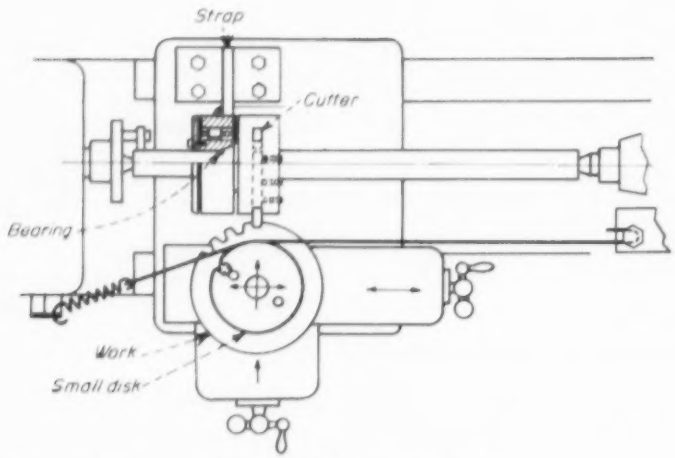
Present method is with the illustrated fixture, which operates much faster, is not constantly being quenched and distorted, and eliminates the strips of solder. It is easy to locate the silver rod in the notch and to slip the brass rod on top.

A bench welder with 3-KVA capacity heats the brass to the melting point of solder, which is run along the rods by hand. Clamps at the ends are connected to the welder electrodes; the hold-down clamps are hardened asbestos.

Solder is inserted where the rods join by hammering the end flat so it slips easily and tightly along next to the rods. The work has a good appearance after soldering, and the nickeled brass is not visibly affected by the heat.

The brass rod has a dia of 5/32 in. and requires a current of 1500-3000 amp to heat it properly.

Jiro Yamazaki, Tokyo, Japan



Arbor Between Lathe Centers Swings Cog-Cutting Tool

Cog wheels (not true gears) can be produced with this kind of setup, with a flycutter carried by an arbor, and with the work held on the compound rest.

The cutter is a simple straight-line tool; there may be several of them mounted in line on the cutter body. The left-hand section of the body has a bearing pressed on the arbor, and with its outer race fixed by means of a strap to the rear of the carriage.

A vertical spindle on the compound carries the work—a disk—and a smaller disk around which is wrapped a cable leading from the headstock to the tailstock. A spring is inserted in the cable to prevent binding as the carriage is moved.

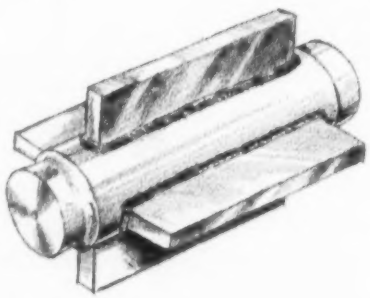
The compound is moved slightly from left to right as the cutters work to full depth. This allows cutting clearance on the sides of the cogs.

After one cog valley is cut, the cross-slide is backed off, and the carriage is moved to the right by this amount:

$$\frac{2\pi}{z}\left(\frac{D}{z}+\frac{d}{z}\right)$$

where z is the number of teeth, D is the dia of the smaller disk, and d is the dia of the work. With the carriage in the new position, a second cut is made in the same way—and so on until the cog wheel is complete. Cutting is done as the slide is fed slowly toward the cutter.

Max Kunz, Sao Paulo, Brazil

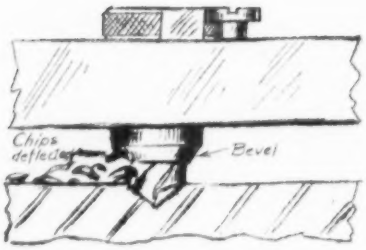


Finned Arbors Save Weight and Work

Large circular parts with big bores had to be ground, and we made up arbors to fit by adding welded fins to smaller arbors, as illustrated.

Three to six fins were added, depending on the ID of the work, and on how much rigidity was required. After welding, we normalized, hardened, and ground the arbors to the necessary OD dimensions. Sizes ran from 1½ to 4 in. before the fins were added. With the fins, we more than doubled the arbor diameters.

Oscar F. Dambert, Springfield, O



Drill Bushing Deflects Chips

If you're drilling tough, stringy steel and want to keep the chips from fouling up your drill fixture, use a bushing designed to steer the chips out and away from the hole.

The bottom of the bushing can be beveled as illustrated. It should not extend completely down to the top of the work in order that clearance for the chips to come out will be left there.

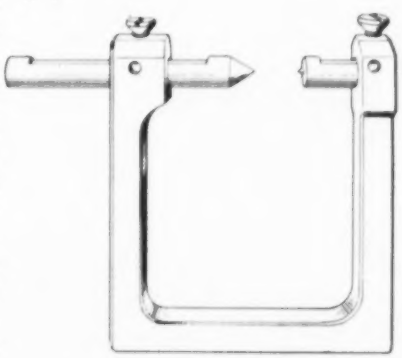
H J Gerber, Stillwater, Okla

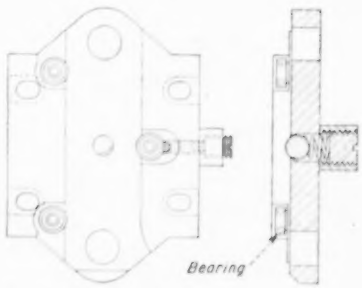
Centerpunch Transfer

If you should want to transfer a centerpunch mark from one side of a plate to the other, and make sure both marks are lined up, a tool like the one illustrated does the trick. A simple steel frame, of any size, is through-drilled, fitted for setscrews, and then provided with two centerpunches.

Both punches have flats cut along one side. One is actually not a punch, but really a piece of drill rod with a small ground tip. This tip is nested in the first centerpunch mark, and the other punch used for marking.

Rudolph K Schmidt, St Albans, N Y



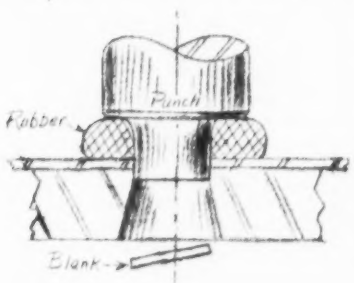


Bearings in Stripper Keep Stock Aligned

This stripper plate has three ball bearings and one spring-loaded ball to keep the stock feeding true. The three bearings keep the edges of the stock lined up as it runs through the die, and the ball keeps the stock flat on the die. Ball and one bearing are spring-loaded to allow for irregularities in stock.

We use this when blanking out chain links, which are stamped from stock that is often bent and twisted. The bearings speed up production quite a bit, allowing an operator to keep the press clutch down as he hand feeds a complete length of stock continuously.

Burton Phillips, Kaukauna, Wis

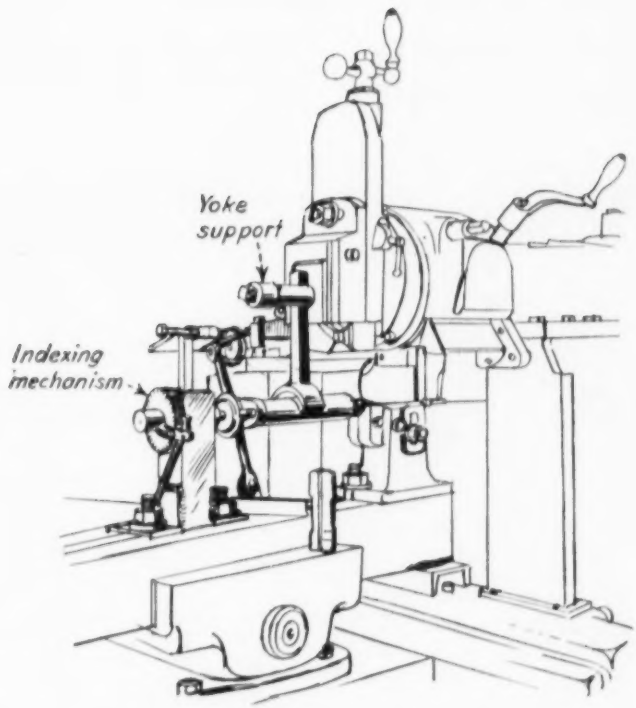


Rubber Stripper Cements to Punch

This is a punch-and-die kink often overlooked: Make stripper of blocks of rubber for economical punching.

Die-buffer rubber is used; bored to a tight fit on the punch. For short runs, it can be slipped in place. For longer runs, it's often best to cement it to the punch.

H J Gerber, Stillwater, Okla



Shaper Polishes Draw Punches

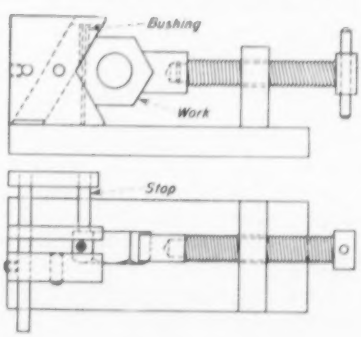
We get faster work and better finishes with this shaper setup than we could with hand polishing. The fixture is a centering and indexing device mounted on the shaper table.

Each punch is mounted between centers—the rear one a tailstock, and the front one a heavy block fitted with center and ratchet mechanism. The ratchet is operated as a bumper on the ram pushes a lever, which results in a slight turn on the work each time the ram reciprocates. Another arm from the ram supports either a stone carrier or a felt-pad yoke.

A stone is mounted with a ⅜-in. piece of foam rubber between it and the carrier—this to even out stone pressure. Kerosene is the lubricant. Polishing is done with a felt pad carrying diamond compound or with a 320-grit piece of paper (for faster work).

The rig has worked for three years, on punches for flashlight cases, and produces good work.

Austin W. Chaffee, St. Albans, Vt

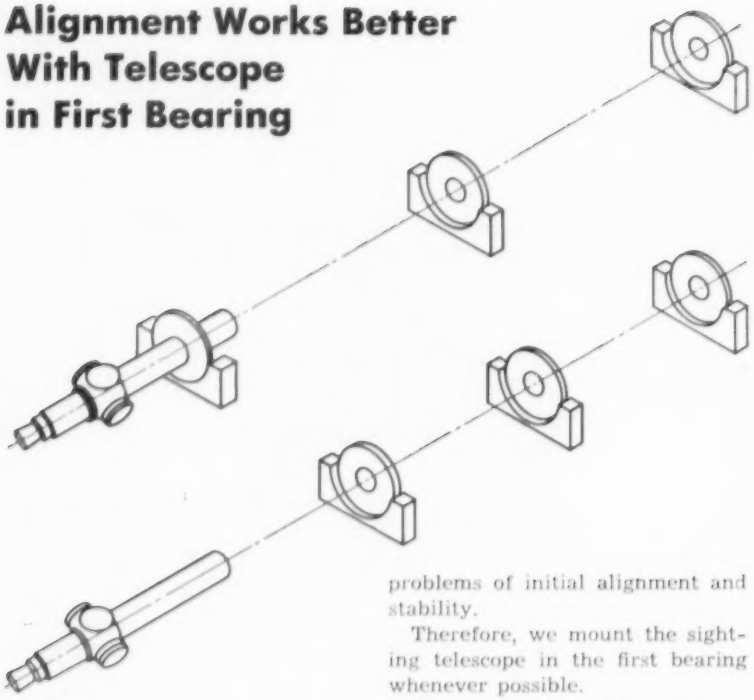


Jig Holds Nuts for Drill

When you have to drill holes for locking wires through nuts or bolt heads, a simple jig like this will hold the work. The base has a V-block, and the clamping anvil is also V-slotted. The hardened V-block attached to the base has a bushing hole for the drill. It grips nuts from ½ to 2 in. across flats.

Arthur Collins, Kirkmichael, Scotland

Alignment Works Better With Telescope in First Bearing

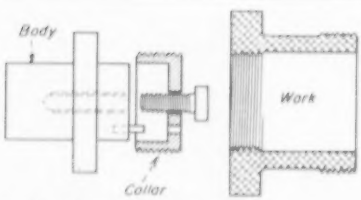


We were interested in reading "Targets Line Up Prop Shafts" (AM—Aug 15 '55, p 117) because we have done similar work. However, we find that using the surveying instrument externally poses problems of initial alignment and stability.

Therefore, we mount the sighting telescope in the first bearing whenever possible.

This is made easier because there are now optical instruments made specifically for tooling, whereas not long ago we had to use a regular surveying tool.

E J Schneider, Engis Equipment Co, Chicago, Ill.



Split Threaded Arbor Releases Work Quickly

After facing, boring, and threading cast-aluminum housings, a second operation required turning the OD. We used standard practice and made a threaded arbor to fit the lathe, and on this we mounted the work. But after turning, we found the aluminum threads jammed, and the flange of the housing pressed tightly against the shoulder of the arbor.

We finally got the first piece off the arbor; then we decided to make a new arbor. The design we chose has a collar which is held to the main body of the arbor by a central setscrew, and located by a dowel. The collar has the thread to match the work.

Now we load the work, turn it, then back off the setscrew slightly. This releases the work completely, and makes unloading simple.

Samuel Seeman, New York, N. Y.

Drilled Mirror Shows Tap Slant

When tapping by hand, I use an army-surplus metal mirror with a ½-in. hole through the middle over the work, through which the tap is started. If the tap starts to slant, it can be easily seen in the mirror; which means I don't have to stop and check the tap with a square.

Nick A Haralampous, Los Angeles, Calif

Winner No. 246

C B WEIDNER

Emmaus, Penna

won $25 in addition to regular payment for his idea:

TUBING TEST

in the issue of March 1, 1956

An extra payment of $25 is made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

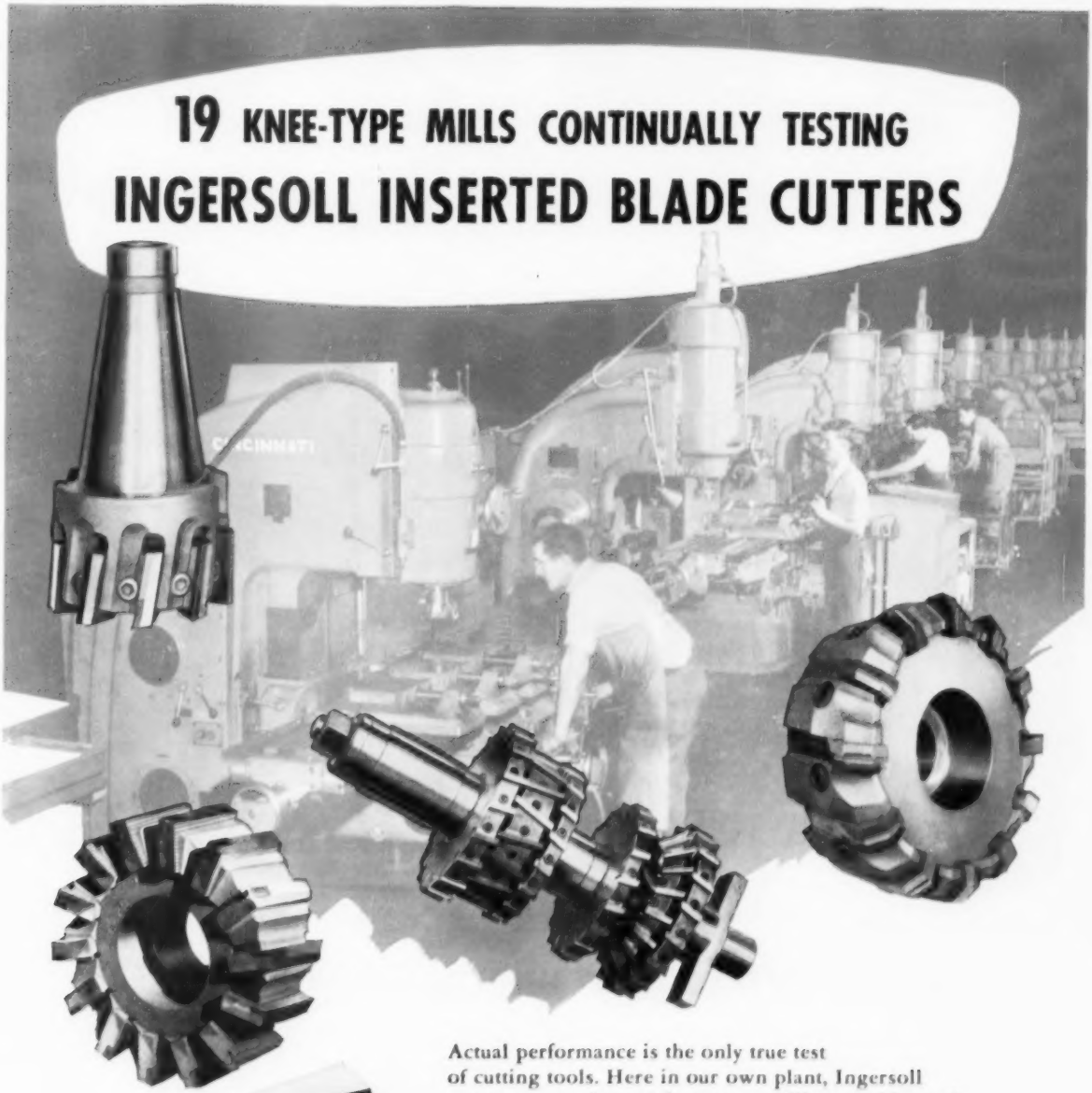
JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N Y

19 KNEE-TYPE MILLS CONTINUALLY TESTING
INGERSOLL INSERTED BLADE CUTTERS



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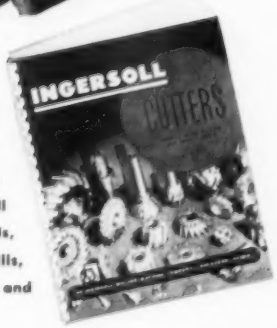
It will pay you to let one of our cutter engineers demonstrate the performance and economy of Ingersoll inserted blade milling and boring cutters.



Write Today for new Ingersoll Cutter Catalog 66K, describing Ingersoll inserted blade face mills, end mills, helical slab mills, side mills, arbor cutters and boring heads.

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Bend Allowances for Sheet-Metal Parts . . . I

R. J. RIZZO, consulting engineer, NEW YORK

Bend allowances are not computed accurately with formulas that incorporate a constant like 1/3 t or 0.4 t. When developing a blank for precision stampings, it is desirable to have data that give closer results, in order to minimize die changes. So, instead of using a formula for effective length of the bend such as $K = \pi/2\ (R + 0.4\ t)$, better results can be obtained for values of K derived by closely controlled experiments. These values of K (see page 157) represent averages for steel, aluminum and brass sheet.

In effect, K, the bend allowance or effective length of bend, does not follow any exact mathematical relationship to the stock thickness or inside radius of the bend. In the theoretical approach, the effective length of a 90° bend may be expressed by the formula (see Fig. 1):

$$K = \pi/2\ (R + 0.5t)$$

This formula assumes that computation of the length of the bend is done at the centerline of the stock, that the metal will orient itself without strain, and that a geometrically perfect corner of uniform thickness and density will be produced. These results are not realized in practice, except for bends having an inside radius of $8t$ or larger, and these comprise only a small percentage of formed parts. For bends with corner radiuses between zero and $8t$, and especially when R is close to zero, the metal flow is poor and the corner is badly formed. Hence, because the theoretical formula produces an excess of metal, an arbitrary constant, ($0.4t$ or even $0.3t$ or $0.35t$) has been assumed by die designers.

When making experiments on brass, steel and aluminum, in various combinations of R and t, it was discovered that the bend allowance is not a constant but varies from 0.318 t to 0.5 t as R increases from zero to 8 t. No equation can be derived, because the variation is erratic. Hence, the tabulated values were developed for a 90° bend, Fig. 2, by means of this formula

$$L = A + B + Ct - x\,R$$

Here a permanent value of 0.5 is assigned to C, and the experimental variable xR is introduced to reflect the manner in which the allowance changes as R/t changes from zero to 8. Hence, when $R = 0$, the above equation reduces to $L = A + B + 0.5\ t$, which is correct for all practical purposes.

The values of x were computed from the experimental results and plotted against the ratios R/t that produced them. From these results it was possible to draw a curve from which any value of x could be extracted. Then with these x values, the bend allowance K was calculated from the formula

$$K = 0.5\ t - xR$$

The table on page 157 was set up by this means.

Of course, two shops working independently will build and run a die on identical blanks and obtain slightly different results. The difference can be traced to size and finish of the bend radiuses on the tools, variation in press speeds, use of lubricant, die space allowed for the metal, etc. Nevertheless, use of the tabulated values should produce more precise results than the customary formulas which do not take account the change in bend allowance required with change in the inside radius of the bend.

Fig. 1

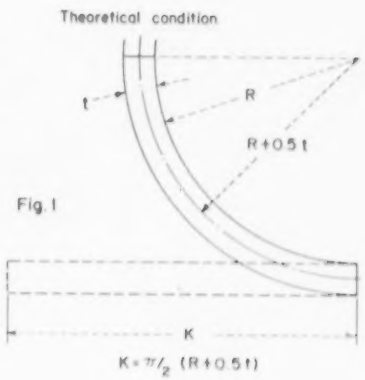
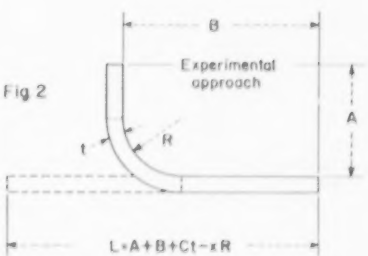


Fig. 2



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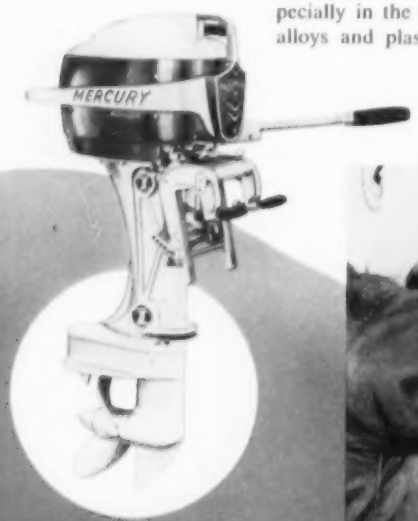
No extra cost for expert advice . . . no need for a special expensive tap, since Bath engineers recommended a stock tap with the proper features to provide the clean, accurate threads required in the precision-built Mercury gear case.

Perhaps this service can save time and money for you, too! In many instances, a simple change in stock tap selection will improve your quality of workmanship and increase production.

If you have a tapping problem — give Bath engineers a chance to dig into their long experience for a solution . . . especially in the threading of difficult metals, alloys and plastics.



Threading aluminum lower unit gear case of a Mercury Mark 25 outboard motor with a ⅜"-16 NF Bath Tap.

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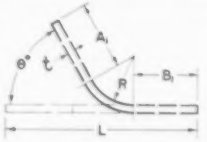
Bend Allowances for Sheet-Metal Parts . . . II

MATERIAL REQUIRED FOR ANY BEND

K's ARE TABULATED BELOW

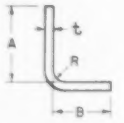
$E = \frac{\theta}{90}(2R \pm K)$ ①

GENERAL EQUATION FOR ANY DEVELOPED BLANK



$L = A_1 + B_1 + \frac{\theta}{90}(2R \pm K)$ ②

SIMPLIFIED EQUATION FOR BLANKS HAVING 90° BENDS



$L = A + B \pm K$ ③

R J RIZZO
consulting engineer, New York
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These figures apply to average conditions when bending aluminum, brass and steel

METAL THICK. ▼	INSIDE CORNER RADIUS – R																
	0	.015	.031	.047	.062	.093	.125	.156	.187	.218	.250	.312	.375	.500	.625	.750	1.000
.015	+.008	+.004	−.004	−.010	−.016	−.028	−.041	−.053	−.065	−.077	−.090	−.114	−.138	−.187	−.236	−.284	−.382
.020	+.010	+.007	−.002	−.008	−.014	−.026	−.039	−.051	−.063	−.075	−.088	−.112	−.136	−.185	−.234	−.232	−.380
.031	+.016	+.014	+.007	−.002	−.007	−.020	−.032	−.045	−.057	−.069	−.082	−.106	−.130	−.179	−.228	−.276	−.374
.036	+.018	+.016	+.010	+.002	−.005	−.018	−.031	−.043	−.055	−.067	−.080	−.104	−.128	−.177	−.226	−.274	−.372
.040	+.020	+.018	+.013	+.005	−.003	−.016	−.029	−.041	−.053	−.065	−.078	−.102	−.126	−.175	−.224	−.272	−.370
.050	+.025	+.023	+.020	+.013	+.004	−.010	−.024	−.036	−.048	−.060	−.073	−.097	−.121	−.170	−.219	−.267	−.365
.062	+.031	+.030	+.026	+.021	+.014	−.004	−.016	−.030	−.042	−.054	−.067	−.091	−.115	−.164	−.213	−.261	−.359
.070	+.035	+.034	+.031	+.026	+.020	+.002	−.012	−.024	−.038	−.050	−.063	−.087	−.111	−.160	−.209	−.257	−.355
.078	+.039	+.038	+.035	+.031	+.025	+.009	−.008	−.020	−.034	−.046	−.059	−.083	−.107	−.156	−.205	−.253	−.351
.093	+.047	+.046	+.044	+.040	+.035	+.021	+.003	−.012	−.023	−.037	−.051	−.075	−.099	−.148	−.197	−.245	−.343
.109	+.055	+.054	+.052	+.049	+.045	+.033	+.015	−.004	−.015	−.027	−.041	−.067	−.091	−.140	−.189	−.237	−.335
.125	+.063	+.062	+.061	+.058	+.054	+.043	+.028	+.011	−.007	−.019	−.031	−.059	−.083	−.132	−.181	−.229	−.327
.140	+.070	+.069	+.068	+.065	+.062	+.052	+.039	+.022	+.004	−.012	−.024	−.049	−.076	−.125	−.174	−.222	−.320
.156	+.078	+.077	+.076	+.074	+.071	+.062	+.049	+.034	+.018	−.002	−.016	−.039	−.068	−.117	−.166	−.214	−.312
.187	+.094	+.093	+.092	+.091	+.088	+.081	+.070	+.057	+.042	+.025	+.005	−.023	−.047	−.101	−.150	−.198	−.296
.218	+.109	+.108	+.107	+.106	+.104	+.098	+.088	+.076	+.064	+.048	+.030	−.008	−.032	−.082	−.135	−.183	−.281
.250	+.125	+.124	+.123	+.122	+.121	+.116	+.107	+.097	+.085	+.072	+.055	+.020	−.016	−.062	−.119	−.167	−.265
▲ METAL THICK.																	

OBSERVATION: STEP-LIKE DEMARCATION IN TABLE ABOVE SHOWS THAT ALLOWANCE IS ZERO FOR BEND RADII OF APPROXIMATELY 1½ t. THEREFORE, FOR COMMERCIAL STAMPINGS HAVING 90° BENDS AND BEND RADII OF APPROXIMATELY 1½ t, THE DEVELOPED LENGTH OF THE BLANK IS EQUAL TO THE SUM OF THE INSIDE DIMENSIONS, WITH NO ALLOWANCE BEING NECESSARY FOR THE BENDS.

EX. 1: θ = 45°, t = .125, R = .750

$E = \frac{\theta}{90}(2R \pm K)$

$= \frac{45}{90}(1.5 - .229)$

$= .635$

EX. 2: A = .75, B = 1.3, R = .047, θ = 90°, t = .062

$L = A + B \pm K$

$= .75 + 1.3 + .021$

$= 2.071$

EX. 3: θ = 90°, t = .078, A = 1.5, B = 4, R = .250

$L = A + B \pm K$

$= 1.5 + 4 - .059$

$= 1.841$

EX. 4: θ = 60°, t = .062, A = 1.0, B = 1.5, R = .125

$L = A + B + \frac{\theta}{90}(2R \pm K)$

$= 1.0 + 1.5 + \frac{60}{90}(.25 - .016)$

$= 2.656$

EX. 5: BUTT SEAM TUBE, t = .031, D = .750

$L = \pi(D \pm K)$

$= \pi(.750 - .031)$

$= 2.480$

NOTE: IN GENERAL, ANY SHAPE IN WHICH METAL FLOW IS RESTRICTED IF PART IS FORMED IN A SINGLE STROKE CANNOT BE COMPUTED. BELOW ARE A FEW

(THESE SHAPES COULD BE COMPUTED IF FORMING WERE DONE IN TWO OR MORE OPERATIONS)

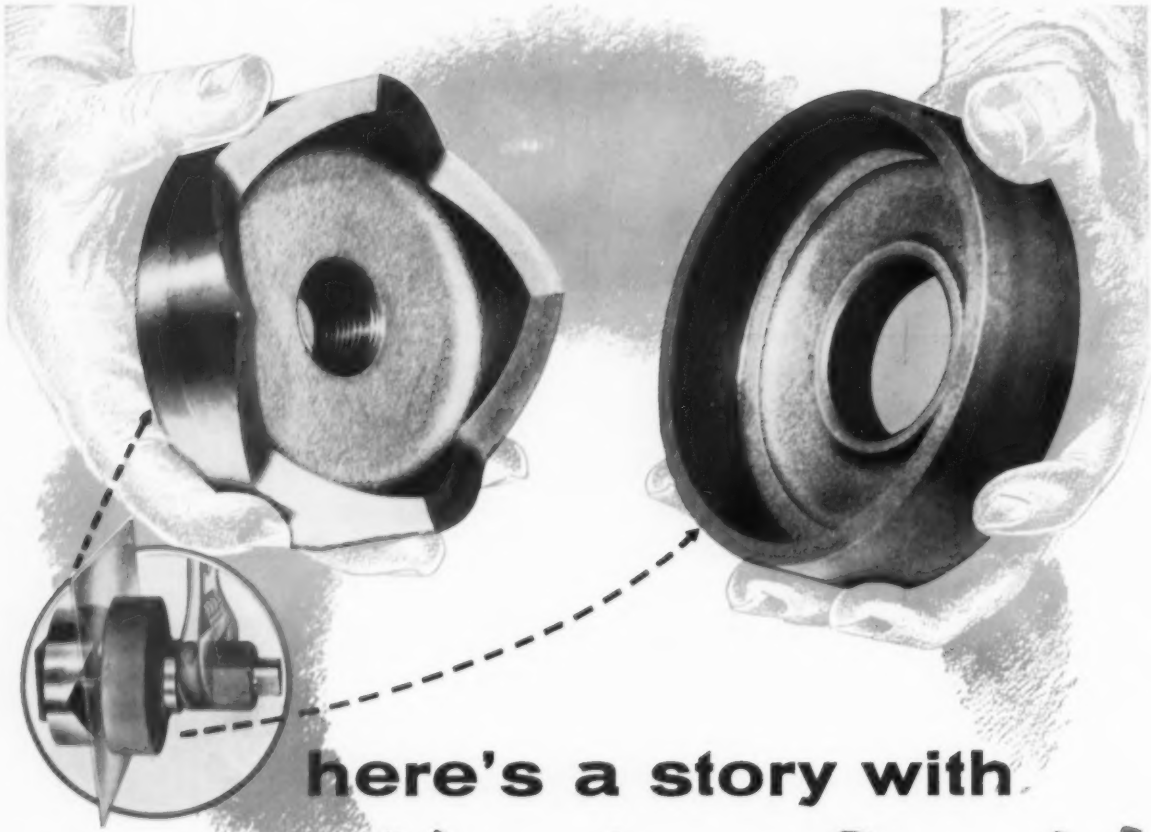
INTERESTING APPLICATIONS

ANY 90° BEND, OR QUARTER CIRCLE, = 2R ± K

A HALF CIRCLE, OR "U", = π(2R ± K)

¾ CIRCLE = 3(2R ± K) = 3(D ± K)

FULL CIRCLE = 4(2R ± K) = 4(D ± K)



This is one of many knockout punches and cutters manufactured by Greenlee Tool Co., Rockford, Ill.

here's a story with a Knockout Punch!

A Tool Manufacturer Made Drastic Reduction in Production Costs by Using a Copperweld Leaded Alloy

Knockout punches involve turning, drilling, milling and grinding. When the Greenlee Tool Co. switched to a leaded alloy their spindle RPM increased 30%, their tool feed from .005″ IPR to .009″ IPR—ID hogging could now be done with only one tool. Tools lasted nearly 10 times as long using leaded alloy. This is another case of cutting production cost by using steel with "built-in productivity."

Freer feeds and speeds and longer tool life can be yours if you switch to Copperweld Leaded Alloys.

For further details, write for free booklet, "Lead Treated Steels"

ARISTOLOY STEELS

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EXPORT: Copperweld Steel International Co., 225 Broadway, New York 7, N. Y.

SELECTION GUIDE FOR STAINLESS STEELS

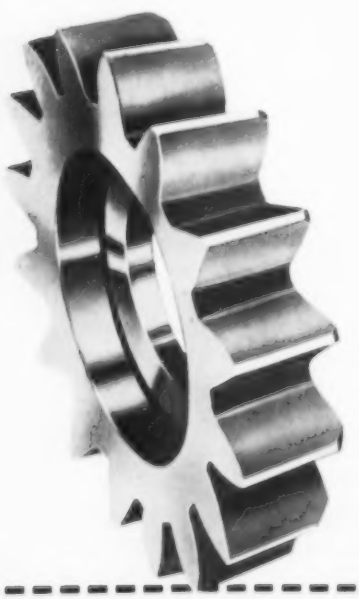
Source: Committee of Stainless Steel Producers, American Iron & Steel Institute

TYPE NUMBER	C% MAX	CR%	NI%	OTHER	STRUCTURE*	GENERAL CHARACTERISTICS
201	0.15	16–18	3.5–5.5	Mn 5.5–7.5	A	Cr-Ni-Mn equivalent of 301
202	0.15	17–19	4–6	7.5–10	A	Cr-Ni-Mn equivalent of 302
301	0.15	16–18	6–8	—	A	Rapid work-hardening rate
302	0.15	17–19	8–10	—	A	General-purpose "18-8"
302B	0.15	17–19	8–10	Si 2–3%	A	Higher scale resistance
303	0.15	17–19	8–10	S 0.15 min.	A	Free-machining version of 302 for heavy cuts
303Se	0.15	17–19	8–10	Se 0.15 min.	A	Free-machining version of 302 for light cuts
304	0.08	18–20	8–12	—	A	General-purpose weldments
304L	0.03	18–20	8–12	—	A	Weldments subject to severe corrosion
305	0.12	17–19	10–13	—	A	Low work-hardening rate
308	0.08	19–21	10–12	—	A	For welding rod and electrodes
309	0.20	22–24	12–15	—	A	Scale resistance & high strength at elevated temperature: 309S for weldments
309S	0.08	22–24	12–15	—	A	
310	0.25	24–26	19–22	—	A	Like 309 but higher heat resistance. 310S for weldments
310S	0.08	24–26	19–22	—	A	
314	0.25	23–26	19–22	Si 1½–3%	A	Maximum heat resistance
316	0.08	16–18	10–14	Mo 2–3%	A	Higher resistance to certain chemicals such as halide salts. 316L for weldments. 317 has even greater corrosion resistance in these applications.
316L	0.03	16–18	10–14	Mo 2–3%	A	
317	0.08	18–20	11–15	Mo 3–4%	A	
321	0.08	17–19	9–12	Ti 5xC min.	A	Stabilized for weldments subject to severe corrosion and/or heat at 800–1650 F. 347 offers even greater corrosion resistance. 348 has very limited application.
347	0.08	17–19	9–13	Cb-Ta 10xC min.	A	
348	0.08	17–19	9–13	Cb-Ta 10xC min.; Ta 0.10 max.	A	
403	0.15	11.5–13	—	—	M	Turbine blading
405	0.08	11.5–14.5	—	Al 0.1–3%	F	Low hardenability for weldments
410	0.15	11.5–13.5	—	—	M	General-purpose 12% Cr type, hardenable
414	0.15	11.5–13.5	1¼–2½	—	M	High-strength version of 410
416	0.15	12–14	—	S 0.15 min.	M	Free-machining version of 410 for heavy cuts
416Se	0.15	12–14	—	Se 0.15 min.	M	Free-machining version of 410 for light cuts
420	0.15	12–14	—	—	M	High hardness from heat treatment
430	0.12	14–18	—	—	F	General-purpose 17% Cr type, not hardenable
430F	0.12	14–18	—	S 0.15 min.	F	Free-machining version of 430 for heavy cuts
430F Se	0.12	14–18	—	Se 0.15 min.	F	Free-machining version of 430 for light cuts
431	0.20	15–17	1¼–2½	—	M	High impact strength
440A	0.60–0.75	16–18	—	Mo 0.75 max.	M	Best combination of strength, hardness and corrosion resistance
440B	0.75–0.95	16–18	—	Mo 0.75 max.	M	
440C	0.95–1.20	16–18	—	Mo 0.75 max.	M	
446	0.20	23–27	—	—	F	For scale resistance in high-temperature use with sulfur-bearing gases

*A—austenitic, not hardenable by heat treatment, hardness and strength increased to varying degrees by cold working.
M—martensitic, can be heat treated for high strength and hardness.
F—ferritic, not hardenable.

Here's the man

who takes the problems out of gear shaper cutter buying



He's backed by the facilities and experience of 44 years of metal-cutting tool development.

Your Illinois Tool Works sales engineer can help you specify the best possible shaper cutters for your individual requirements. He offers the extensive facilities of Illinois Tool Works for the design and production of efficient gear tooling, and through years of personal experience, he can suggest the most effective use of all gear generating equipment. Have this man come in to talk about precision shaper cutters made to your needs. You'll find his advice helpful.

"Know Your Gear Shaper Cutters"

Send for this valuable booklet today! It contains information on how tooling costs per gear can be reduced—efficiency improved. Write for your copy, now!

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Look to your Illinois Distributor for the most complete line of standard end mills, standard milling cutters and special cutters.

Talking Shop . . .

Maintenance the Culprit

PROPER MAINTENANCE and operation of transfer machines is proving a real problem in major auto plants. Makers get rush calls for service men, who find that out-of-tolerance problems stem from improper operation and inadequate maintenance. Even automatic gaging is causing its share of trouble, again as a result of inadequate maintenance. Some automatic gages are even bypassed on occasion because the maintenance men haven't done their jobs well. All of this points up personnel-training problems now skyrocketing.

Hydraulics Again

PACKARD-CLIPPER DIV, Studebaker-Packard Corp, has completed a 40-week industrial-hydraulics preventive-maintenance program at the Utica, Mich, plant. Emphasis was on hydraulic-element maintenance, particularly on automated equipment. Course covered 12 categories, required 2 hr per week.

Queer Names

TANTALUM capacitors (new ones have no liquid electrolyte) are being used in switchgear and missiles with transistors, selenium rectifiers for dc conversion and now in alternator-rectifier systems for 2-way radio-equipped vehicles. Columbium is going into nuclear reactors. Silicon and titanium-oxide rectifiers are under test. Such are recent uses of little-known metals.

Sparklers

INDUSTRIAL DIAMONDS are now being produced synthetically in limited quantities at Carboloy's Detroit pilot plant. GE estimates a potential business of $200 million a year, if costs can be reduced. Current production of natural diamonds is about 2½ tons a year, about 90% of which come to the U S. Most go into tools—at a cost of about $50 million. Synthetic diamonds could replace about 80% (by weight) of the industrial diamonds now in use.

Belts Create No Stress

WHAT EFFECT does abrasive-belt grinding have on hardened steel? Does it cause surface stresses? Production Engrg Dept at Lockheed Aircraft, Burbank, Calif, decided to find out. A series of tests, run on a laboratory basis, showed that abrasive-belt grinding produces a neutral or compressive surface, and will relieve tension stresses caused by wheel grinding. This was the critical problem, because even proper wheel grinding creates a little tension stress, which in turn causes cracking of plating from hydrogen embrittlement. Tests were run with 80, 180 and 220 belts, suggest a solution for an old, old problem.

Almost Edible

FINELY GROUND pecan shells and apricot pits are the blast medium for removing enamel insulation from tiny wires used in electrical coils for thermostats. Cost is a fraction of what it was for chemical treatment, or burnishing, reports Minneapolis-Honeywell Regulator, and production is 1000 pph instead of the same number per day. For more-sensitive coils, powdered corn cobs become the blast medium.

Zirconium Comes Along

SEMI-CONTINUOUS PRODUCTION of zirconium sponge will be initiated next year in a new plant at Ashtabula, Ohio, of US Industrial Chemicals Corp. The plant will use sodium and chlorine from the USI plant already there, will produce 1,500,000 lb of zirconium a year at a price about half the present $14/lb. The sodium process requires much less investment than the conventional Kroll process, and gives a high-purity product. Zirconium has high corrosion resistance, especially to caustic soda and HC1, and can in this case retain the hafnium content, cutting cost to about $3.50/lb, as compared with the present $10. The mineral is fairly common — much more so than many familiar metals —is easily machinable (*AM*—Mid-Nov '55, p116-118).

Sticky Metal

GALLIUM, the metal that melts in your hand, but doesn't boil until 3500F, has been mostly a curiosity since its discovery 80 years ago. Now, however, Alcoa finds it has promise as a sealant for glass joints and valves in lab equipment. Silicone grease, commonly used as a sealant, evaporates under high vacuum, and is dissolved by cleaning solution. Gallium resists both types of attacks, clings instantly to glass, expands as it solidifies (at 86.5 F). This reduces frequency of dis-assembly to correct a leaky joint. In one case, effective operating time on a ground-glass joint was doubled.

Mousetrap

FIVE YEARS AGO, Bell-Rae Chemical Company, Morton Grove, Ill, began to market in the Chicago area a highly concentrated phosphoric-acid-base liquid for pre-plating cleaning called Kem-Bond. Based on data obtained from Germany, it includes several secret additives. It produces a very thin phosphorized coating, thinner than that by Bonderizing, and without heating. Furthermore, it doesn't cause "chalking out," doesn't cause gassing, bubbling and flaking of the plate as muriatic or sulfuric solutions often do. All in all, it's quite a good product, say users, but it has been hidden from Metalworking in general because of purely local distribution. The old story of the mousetrap seems to be falling by the wayside; so much happens these days that nobody detects the light under a bushel.

News of Metalworking . . .

McGraw-Hill Survey of Business' Plans Shows . . .

'56 Launches Four-Year Capital Spending

NEW YORK—This year, U S business will spend an unprecedented $39 billion for new plant and equipment, touching off four years of the highest capital spending in history. Those are the findings of McGraw-Hill Department of Economics' brand new Survey of Business' Plans for New Plant and Equipment 1956-1959. Some 88% of the firms surveyed in every field of U S business were able to report their specific spending plans and anticipated sales as far ahead as 1959. Here's what they report:

● Manufacturing companies plan to increase capacity 8% this year, and another 18% by 1959. When you figure that most of these companies were operating at nearly 100% at the beginning of this year, and that most prefer to operate at below 90% levels—it's apparent that even this year's record expansion won't be enough to restore the margin of reserve capacity if sales outrun those of 1955.

New Products in Key Role

● Development of new products will play a key role in industry's expansion plans for 1956-1959. As a group, manufacturing companies expect new products (those not in existence in 1955) by 1959 to account for 11% of all sales. And 30% of the reporting companies say a good share of their capital spending will go for facilities to make those new products.

● Business already has plans to increase expenditures for research and development 33% above 1955's $5 billion level by 1959, and this figure could increase considerably.

Manufacturing is high on the list of planned increases for 1956 over 1955 with an overall jump of more than 45%. Others: mining 34%, petroleum 11%, railroads 62%, other transportation and communications 33%, utilities 15%, and commercial enterprises 20%. Many manufacturing companies plan to hit the peak of their spending programs not in 1956, but in one of the following three years.

Metal Industries High on List

Within the manufacturing group, largest planned increases are credited to: nonferrous metals (123%), paper (83%), steel (82%), automobiles (81%). The machinery industry itself will step up 1955 spending by 35%.

Autos Biggest Spenders

Dollarwise, the automotive industry will top the manufacturing field with a 1956 outlay of $2 billion. Following this is steel with $1.6 billion, and chemicals with $1.4 billion. And for the first time in any one year, the machinery industry's outlay will top the $1 billion mark. "Other metal products" (this includes many capital goods components) will also top $1 billion, with petroleum refining, paper and food close behind at $800 million.

Non-manufacturing industries that constitute major markets for metalworking products will step up their capital goods buying this way: coal mining 50%, iron mining 44%, railroads 62% for 1956 and more than $1 billion a year for 1957-1959. Also slated for heavy spending are telephone and telegraph companies, airlines, gas and electric utilities. Capacity-wise, it means that U S manufacturing companies by this year's end will have nearly half again as much capacity as they did at the outset of Korea—and most industries today are operating at 100% capacity levels!

Manufacturing Will Increase 26%

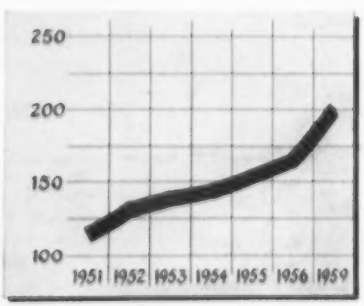
More and more manufacturing expansion is obviously in the cards. If present plans are carried out, manufacturing capacity will increase about 26% from 1956 through 1959. And manufacturers' anticipated sales increases will keep pace with added capacity during that time: trailing just slightly with 24%. The slight margin of capacity over sales increases is necessary to keep operating rates down to preferred levels and to restore a desirable margin of reserve capacity.

Equipment vs Construction

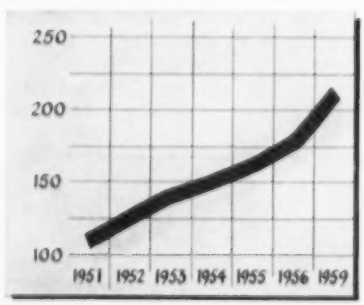
How much manufacturing money will go into new equipment and how much into new construction? The survey shows that 29% of the capital goods dollar will go into new construction, the rest into new equipment. That's the primary reason why the capital goods industry itself (machinery, electrical machinery and transportation equipment) expects the biggest sales in-

Here's How US Metalworking Is Expanding

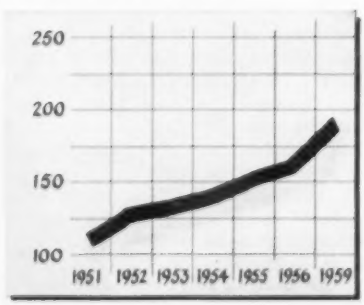
Machinery



Electrical machinery



Automobiles



Skyrocket

crease of any group in 1956. And this industry foresees only a moderate tapering off in this rate of growth for 1957-1959. It is interesting to note that the expected sales increase for capital goods for 1956 is about 15% in physical volume, compared to reported plans for a 30% increase in the dollar volume for capital spending.

This suggests two possibilities:

- Capital goods makers may not be able to keep up with demand.
- Planned expenditures, dollarwise, reflect a substantial increase in costs of construction and equipment over the last year—and may anticipate price increases.

Aside from the capital goods makers, most industries anticipate only a moderate growth for the next four years, like steel and autos. Chemicals, oils and other growth industries expect to maintain their established trend, while the beverage and textile industries hope to improve their growth rates.

New Product Potential

New products will play a tremendous role in the future sales and expansion rates in almost every industry and business. This is particularly true of manufacturing companies who, as a group, expect 11% of their 1959 sales to be in products not made in 1955. In a number of manufacturing lines, where product development is planned far in advance, more than 20% of 1959 sales will be in products that didn't exist last year. This is particularly so in

(Continued on next page)

HERE ARE U S BUSINESS' PLANS FOR CAPITAL SPENDING THROUGH 1959

(millions of dollars)

	1955 (actual)	1956 (planned)	(1955-56) % change	Preliminary plans 1957	1958	1959
ALL MANUFACTURING	$9,440	$13,998	+48%	$13,225	$11,152	$10,175
Petroleum industry	4,992	5,542	+11%	5,926	5,994	5,954
Mining	318	427	+34%	325	331	302
Railroads	923	1,495	+62%	1,136	1,022	991
Other transportation and communications	3,403	4,526	+33%	4,586	3,972	5,048
Electric, gas utilities	4,309	4,968	+15%	5,459	4,763	4,413
Commercial	7,349	8,819	+20%	8,466	7,873	7,479
ALL BUSINESS	30,030	38,965	+30%	38,078	34,146	33,574

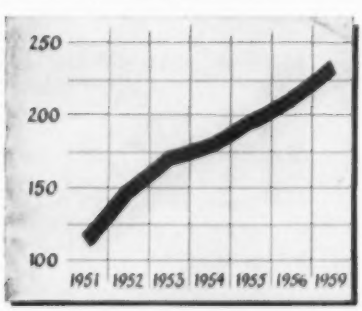
CAPITAL SPENDING PLANS OF MANUFACTURING COMPANIES THROUGH 1959

(millions of dollars)

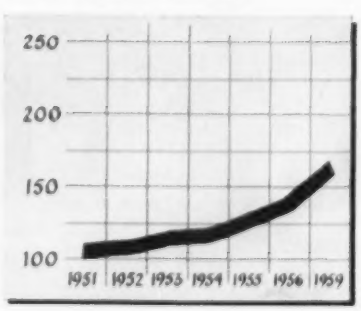
	1955 (actual)	1956 (planned)	(1955-56) % change	Preliminary plans 1957	1958	1959
Iron and steel	$ 879	$ 1,600	+82%	$ 1,584	$ 1,331	$ 1,171
Nonferrous metals	293	653	+123%	986	454	236
Machinery	809	1,092	+35%	902	844	828
Electrical machinery	436	528	+21%	544	506	450
Automobiles	1,128	2,041	+81%	1,654	1,042	1,042
Transportation equipment (including aircraft)	274	397	+45%	318	251	233
Other metalworking	729	1,059	+45%	973	949	842
Chemical	1,016	1,433	+41%	1,576	1,513	1,468
Paper	518	948	+83%	891	784	666
Rubber	150	224	+49%	215	234	194
Stone, clay, glass	498	706	+42%	547	481	430
Petroleum refining & chemical	704	810	+15%	1,045	961	788
Food and beverages	718	802	+12%	764	685	659
Textiles	366	381	+ 4%	343	310	313
Miscellaneous manufacturing	922	1,324	+44%	883	807	855
ALL MANUFACTURING	9,440	13,998	+48%	13,225	11,152	10,175

Capacity (Base Index Year: 1950=100)

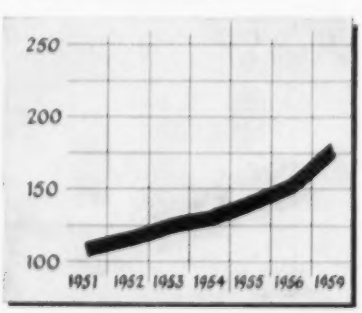
Aircraft, transportation



Other metalworking



All Manufacturing



CAPITAL SPENDING (Continued)

aviation instruments, construction machinery, electrical machinery, office machinery and chemicals. The 1959 11% figure may be considerably higher when firms with hard-to-predict product trends turn in their results for that year.

New products mean new capacity: 28% of all manufacturing companies report that a good share of their 1956 expansion money will go into the making of new products, and that this percentage will rise in the future because of the increasing pace of research.

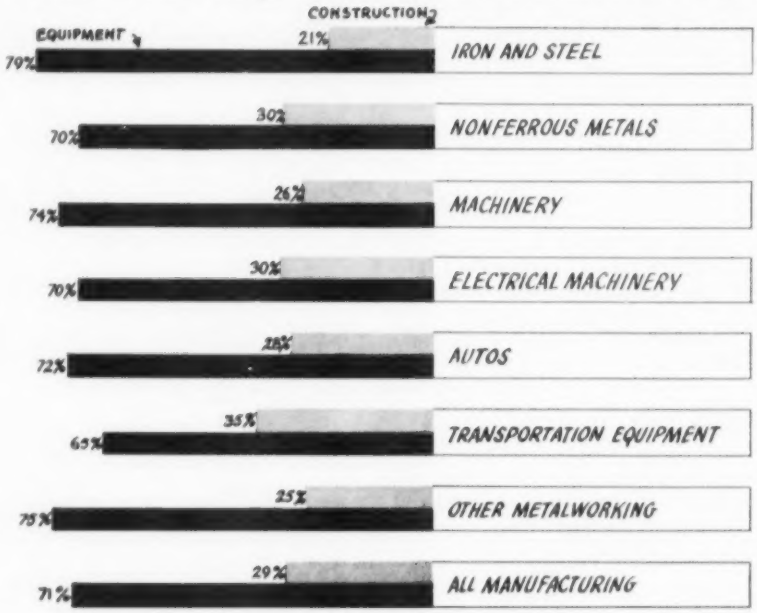
The industries that will spend the highest proportion of their capital investment on new product facilities are: automobiles, chemicals, rubber, electrical machinery, and transportation equipment (includes aircraft). Each of these industries plans to spend more than a third of its capital outlay on new products this year. This means industry is doing more than just expanding capacity in hopes of higher sales—it is creating new sales potential, and obsoleting much of its existing capacity—by introducing new products.

First information ever compiled on plans for research and development spending is reported in the McGraw-Hill Survey. In 1955, all business spent nearly $5 billion on R & D, with aircraft, chemicals, and machinery makers leading the way. Now, the survey shows, the biggest R & D spenders over the next four years will be automotive, primary metals, and machinery

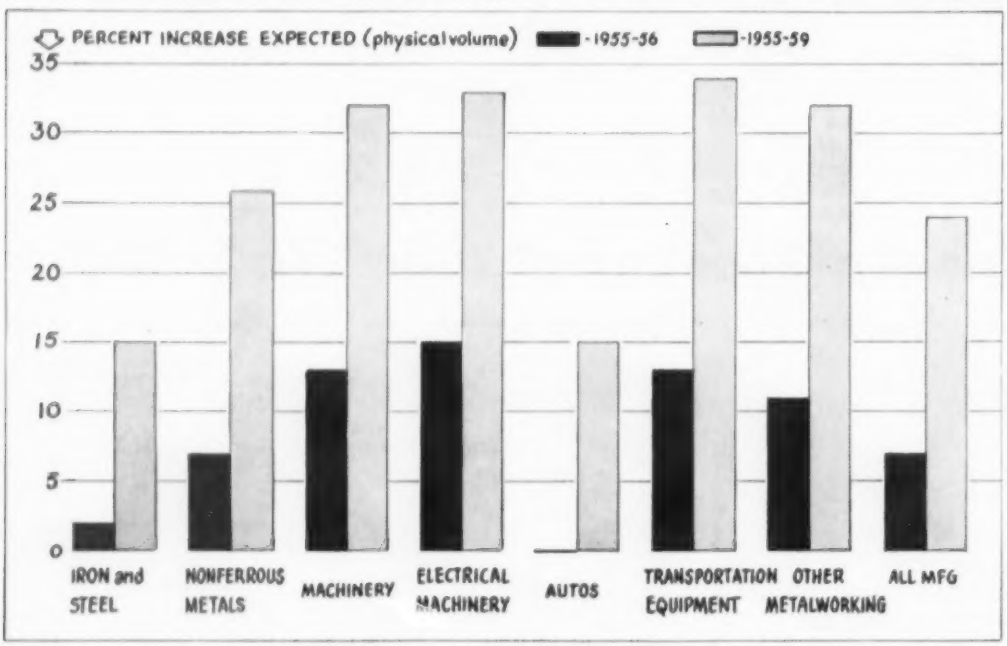
Total R & D spending increased 29% from 1953 to 1955. It will increase another 33% by 1959.

What does this increase in research mean? That we will see a continuing flood of new products—and high capital spending to produce them in the next four years.

Where the Capital Goods Dollar Will Go



Here's How Metalworking Expects to Increase Sales by 1959



White House Backs Wilson on B-52 Hassle

WASHINGTON — The administration has moved onto the offensive against numerous critics, most of them Congressional Democrats, who complain the government is not spending sufficient money to buy defense safety, especially in air strength. President Eisenhower himself has entered the verbal combat to back-up defense secretary Charles E Wilson and lesser administration spokesmen who are being kept busy answering critical barbs emanating from Capitol Hill.

The shooting, by both sides, is going on—and it will continue for some time. One thing, however, has been established: US military spending for defense will be on the rise during the coming years.

In fact, it will be greater during the next fiscal year than originally planned. Within the past two weeks, Wilson has announced an increase of about $600 million during fiscal 1956—the year ending June 30—over his last prior estimate.

'56 Budget Will Be Higher

Last August, Wilson was figuring the Defense Dept could get along in fiscal 1956 with about $34.5 billion. Now he admits that was on the conservative side, that actually the figure will be about $35.1 billion.

A combination of factors has thwarted Pentagon (and White House, too) desires for a reduction in spending. Operating economies and delivery delays were counted on to pull down the figure this fiscal year. Neither has materialized, and moreover labor and material costs have increased.

This is where the administration draws the line at explanations. Actually, it seems that another element should be also taken into account—the Democratic pounding.

One of the recent effective blows was testimony by General Curtis E LeMay, chief of the Strategic Air Command, that Russian long-range bombing capability will surpass that of the US by 1958-'60.

LeMay was the prize witness turned up thus far by a special Senate subcommittee headed by Senator Stuart Symington, Missouri Democrat. Within 24 hours, Wilson disagreed with LeMay but conceded Russian heavy-bomber production is outstripping ours. Then it was that Wilson took off some of the edge by announcing the new $600 million estimated rise in spending this fiscal year.

LeMay was concerned primarily with the slow buildup of the B-52 fleet, the heart of his intercontinental striking force.

Eisenhower went to Wilson's aid by saying that appraisals of our military strength should not be confined to one element in the picture —in this case, the SAC—but should take a broader view. Eisenhower laid stress on a worldwide ring of US air bases which would make medium bombers effective striking at any enemy.

In medium bombers, the US excels, with a fleet of some 1700 B-47s. Moreover, Eisenhower held it is particularly important to remember that the US Navy is the strongest in the world and "it features one thing, air power."

Nevertheless, Democrats were not mollified. The Senate Appropriations Committee called Wilson up to the Capitol and demanded justification for what Democrats consider the skimpiness of his fiscal 1957 military budget—$35.9 billion.

Wilson tried to do that. Whether he succeeded in convincing skeptical Democrats remains to be seen, but the Defense Secretary did take the play away from his critics by:

- Revealing that B-52 production schedules have been raised again. Now the goal is 20 a month, and although Wilson didn't say so, it reportedly should be reached by 1956.

The B-52 output is now six a month. In raising the sights again, Wilson and the administration have moved up for the third time. A year ago, the ultimate plan was for production of 12 a month. This was increased later to 17. The military planners went into a huddle a few weeks back and decided to go for 20 a month after Eisenhower asked Congress to add $248 million to the Air Force budget for the coming fiscal year.

- Disclosing the Armed Forces will spend $3 billion for research, development and production of guided missiles during fiscal 1957. Democrats consider this another "soft spot."

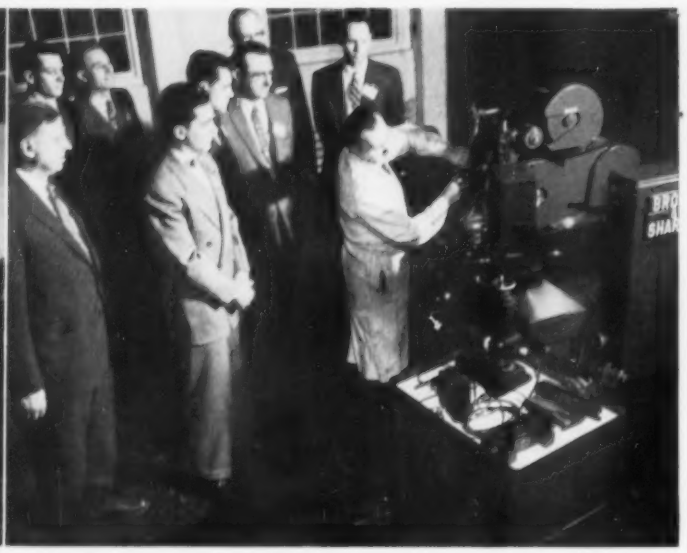
First Commercially Built Plastic LCVP for Navy

ANOTHER STEP TOWARD PLASTIC NAVAL VESSELS occured April 19 when California's Zenith Plastics Co turned this all-plastic-hull LCVP over to the Navy for testing. It's the prototype of a 25-vessel order. More than 80% of the vessel is of reinforced plastic, with the hull of paper honeycomb core with woven glass fiber reinforced inner and outer skin

News of Metalworking . . .

Brown & Sharpe Dedicates "Precision Center"

Milling machine section . . .
keynote is universality-plus. New sliding-head Rangemaster, for example, permits horizontal, vertical, angular milling in one setting



Grinding machine exhibit . . .
has machines ranging from a tool-and-cutter grinder just a few sq ft in area to a large, versatile universal grinder for toolroom and production work

Labor's Bellwethers (UAW-USW) Aim in Opposite

WASHINGTON—As 1956 approaches a prosperous mid-year mark, the nation's two largest industrial unions are fast becoming the focal points for organized labor's special concerns—collective bargaining and employment. Curiously, in closely related industries, the AFL-CIO'S United Steelworkers and Auto Workers Unions are moving in opposite directions. The steel union is ready to step into a round of bargaining with a big set of demands; the Auto Workers are seeking to stave off advancing unemployment.

In rapid steps:

● David J. McDonald's Steelworkers served formal notice terminating contracts in the basic steel industry on June 30. The major producers came right back with the same 60-day notice on the union. Bargaining will be under way by next month.

● UAW President Walter Reuther proposed a top-level committee of industry and union leaders to discuss mounting unemployment in the automobile industry. He placed the jobless figure at above 150,000 and estimated it would rise still further.

This paradox is the result of an economic situation that finds the steel industry producing at peak production and profit levels, while automakers are battling to diminish a high inventory of 1956 automobiles.

In bargaining, McDonald's negotiating team, primarily, will be out to better contract settlements won last year by Reuther's Auto Workers. The UAW, under a three year contract, will receive an average 7¢ boost this year. Steel is expected to demand twice this amount and perhaps settle for 12¢ in wages.

In addition, USW wants a supplementary unemployment benefit plan that would outdo the auto industry's 5¢ an hour plan. On top of this, it will seek to have the steel producers pick up the entire cost of social insurance.

The final proposed demand by USW is the clincher—overtime pay for weekend work in an industry that works around the clock seven days a week. Costs of this proposal alone run as high as 40¢ an hour.

The industry is angry over two events; the union's costly 12-hour strike over wages in 1955, and its demand for overtime weekend pay this year. There's some feeling that the latter demand is set up as a giving point by the union if it wins a high-priced settlement. If USW is serious, it could mean a strike.

In any case, the final steel contract terms are expected to be costly—estimated anywhere between a 12¢ and 20¢ package.

A major factor is the aircraft industry, where most of this year's agreements are already in. In line with the aircraft pattern, the latest contract—between the International Association of Machinists and Convair Aircraft in Texas—provides an estimated 27¢ package for two years.

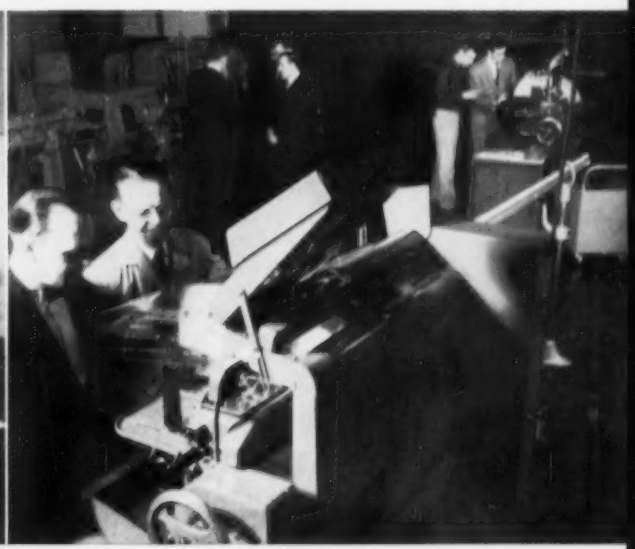
So far this year, wage settlements are running several cents higher than 1955. More than half the increases—ranging from no increase to 19¢ and over—are between 7¢ and 12¢. This compares with 4¢ to 9¢ for 1955.

Unemployment in the auto industry will be an issue in steel bargaining, though on the fringes. Auto employees begin payment on last year's Supplementary Unemployment Plan

Field Report USA!

As Headquarters Showcase for Its Products...

Industrial products exhibit . . .
displays precise measuring tools with new, easier-to-read scales, micrometers, and new types of height gages, cutters, etc



Screw machine section . . .
features machines that can be run as fast as practicable for the tool material and work material involved, cut set-up time

Directions

June 1, when the discharged workers begin receiving auto company payments in addition to state jobless benefits. This will be watched by the steel producers as the first major test of SUB, and it will affect their bargaining attitude.

200,000 Auto Jobless?

UAW economists are predicting unemployment in the auto industry will mount to close to 200,000 by the fall, paralleling the situation in 1954 when the unemployment totalled 190,000. Besides its economic implications, auto unemployment had a major effect in the national elections in Michigan and is cited as the number one cause for the defeat of Republican Senator Homer Ferguson.

UAW's Reuther will attempt to make this a national political issue in the AFL-CIO's support for the Democratic Party in the upcoming elections. The Eisenhower administration will be blamed for auto unemployment, though the national average on employment and wages will be high.

Huge (80 x 200 ft) Exhibition Hall Provides "One Stop Service" for Toolrooms

PROVIDENCE, R I—Now it's easy to evaluate B & S machine tools and industrial products at one time and in one place—Brown & Sharpe Mfg Co's newly dedicated 80 x 200 ft "Precision Center," where you can see, operate and discuss several hundred thousand dollars' worth of machine tools and equipment.

178 New Items

One reason for the new exhibition center is the phenomenal growth of the Brown & Sharpe line within recent months — in the last nine months the company has added 178 items to its line—aiming at a "one stop service" to fill toolroom needs for precision tools, gages, measuring equipment, cutters, magnetic chucks, milling machines, grinders, and cutter grinders.

The Precision Center is divided into four sections to correspond with B & S's four principal product lines: screw machines, milling machines, grinders, and industrial products. The latter handles gages, precision tools, magnetic chucks, vises, granite surface plates, coolant pumps, cutters, and a super-de luxe toolbox.

The screw machine section features machines redesigned to use any tool or work material at the proper speeds and feeds, plus new tooling that simplifies setup and maintenance. An example: a brass part is made at the Center on a No. 00 automatic in 9⅜ sec, or 60% faster than formerly.

All milling machines shown are of modern design, except the original universal miller built in 1861 by J R Brown.

A new face grinder featured in the grinding machine section gives a completely new approach to this kind of work, producing exceptionally close limits and finish on a pump gear.

Industrial products section displays, among many other products, new, lower magnetic chucks that add ⅞ in. to the effective work height when mounted on a surface grinder, and that have a stronger grip.

Field Report USA:

East...

Scanning the East . . .

Henry Owens & Co Inc, Cranston, R I, has taken over manufacture of the 616 cylindrical grinding and indexing attachment from **Brown & Sharpe Mfg Co,** Providence . . . **Eastern Stainless Steel Corp,** Baltimore, is issuing upwards of $5 million in debentures to finance an expansion program . . . **Automatic Switch Co,** Orange, N J, has started work on a 120,000-sq-ft manufacturing plant at Florham Park, N J, 15 miles west of Newark. It will double output of the Orange facility . . . **ALCO Products Inc,** Schenectady, has an $859,826 contract from the New York State Power Authority to build 34 diversion tunnel gates for the St Lawrence River power project . . . **Cooper Alloy Corp** will add 7800 sq ft to its Hillside, N J, foundry, and is expanding its Aircraft Products Division at Clark, N J . . . Take-home pay in the Metropolitan New York-New Jersey area is at an all-time high of $71.48 per week . . . **Allen Mfg Co,** Hartford, Conn, maker of hex socket set screws, has been bought out by **Chicago Pneumatic Tool Co** . . . **Acme Chain Corp,** Holyoke, Mass, will build a $600,000, 85,000-sq-ft plant at Holyoke, doubling its output of industrial transmission chain . . . **United Shoe Machinery Corp,** Boston, will build atomic reactor components for **GE's Knolls Atomic Power Lab,** Schenectady . . . **Sylvania Electric Products Inc** has bought out **Formatic Machine Co,** Naugatuck, Conn, manufacturer of eyelet machine parts . . . **C N Flagg & Co Inc,** Meriden, Conn, installers of industrial boilers, heating systems, etc, has moved to new quarters at 48 Elm St, Meriden . . . **Westinghouse Electric Corp** reports it shipped upwards of $225 million in products in the first quarter, but its prolonged **IUE** labor strike forced the company to take a net loss of nearly $19 million . . . Military orders of $25 million have upped the backlog of **American Bosch Arma Corp,** Garden City, L I, N Y, to $195 million in military orders only . . . **Metal Lace & Stitch Co,** New York, is now marketing the Williams Metalace method of metal joining . . . **Crucible Steel Co of America,** Pittsburgh, will fabricate and sell steel springs for industrial use . . . **General Electric** will spend $1.2 million on expansion of its Small Turbine and Supercharger Dept at Fitchburg, Mass. Plans call for a new high-pressure boiler plant, two test pits, and a $200,000 10-ft vertical boring mill . . . New York's **Continuous Metalcast Co** has licensed its Tessmann aluminum casting process to **Scovill Mfg Co,** Waterbury, Conn.

Midwest...

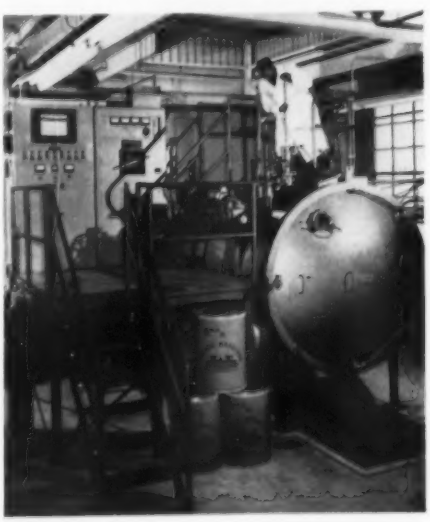
Midwestern briefs . . .

AT & T's Capehart Farnsworth Division, Fort Wayne, Ind, has been sold to **Gross Corp,** New York, with output halted May 14. Gross will continue C-F radio and TV set manufacture elsewhere, marketing it under the Capehart trademark . . . **Cole Products Corp,** Chicago maker of automatic-cup drink dispensers, has started work on a $350,000 office and warehouse in Highland Park, Ill, will do some minor component manufacturing there, too . . . **Illinois Tool Works,** Chicago, is setting up a British subsidiary in London to distribute its products in Europe. It's called **Shakeproof Ltd** . . . Hoosier economists at the **University of Indiana** say that by 1970, Indiana will have personal incomes 45% higher, 35 hr workweeks, 77% more output of goods and services for an $18 billion a year total, and that it will have 2-million workers . . . **GE's** new Bloomington, Ill, plant, finished just last fall, will be expanded 10% . . . **Johnson Motors Division** of **Outboard Marine & Mfg Co,** Waukegan, Ill, will add 197,000 sq ft to its manufacturing space—almost all of it for outboard motor production . . . **Borg-Warner Corp** has purchased a 53-acre site in Broadview, Ill, for future expansion of its Spring Division, now in Bellwood, Ill . . . **Service Plastic Corp,** Chicago, will move all its operations into a new, 26,000-sq-ft building . . . **Airmaster Corp,** Chicago, has purchased 65,000 sq ft more of floor space at two Chicago locations . . . **Whirlpool-Seeger Corp** has begun work on a 90,000-sq-ft addition to its Evansville, Ind, plant. It's part of a $19-million 1956 expansion program, which includes some $8 million for retooling its 1957 refrigerator and freezer lines . . . **Wausau Iron Works,** Wausau, Wis, will up its manufacturing floor space to 100,000 sq ft, with a new building . . . **Cleveland Cap Screw Co** has leased its No 2 plant in Cleveland to **GM's Euclid Division.** Its machines and equipment have been moved to Cleveland Cap Screw's new plant in southeast Cleveland . . . **Twin Coach Co,** Kent, Ohio, plans to sell one of its five Kent plants, the body facility, to **Purolator Products Corp,** Rahway, N J . . . **Fairbanks, Morse & Co** will move its Electronics Division from Davenport, Ia, into the F-M Scale Works in East Moline, Ill . . . **Nortmann-Duffke Co,** Milwaukee metal perforating firm, has changed its name to **McKay Perforating Co Inc** . . . **Pratt & Whitney's Sterling Die Division** will move into a three-times-as-big plant in Southwest Industrial Park, outside Cleveland . . . **Caterpillar Tractor Co** will build a 1.25-million-sq-ft plant on 350 acres near Aurora, Ill, will make two models each of crawler tractors and crawler shovels there.

South...

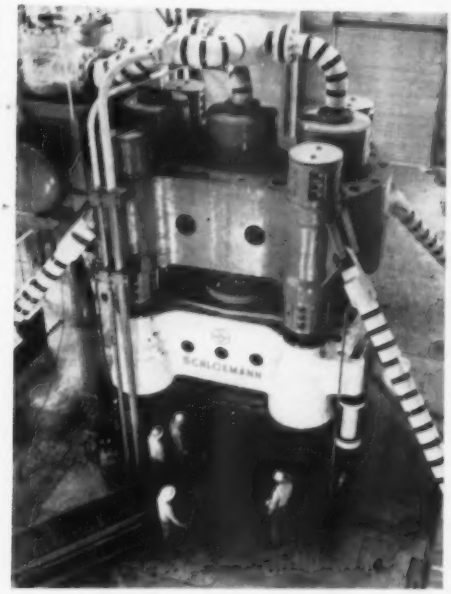
Dixie newsnotes . . .

Lockheed Marietta (Ga) has a new multi-million-dollar contract for electronic modification work on B-47's. First plane arrived for revamping in April . . . **Rudisill Foundry** of



Vacuum Melting Furnace...

available to the metalworking industry for experimental and production use goes to work at Cannon-Muskegon Corp, Muskegon, Mich. It'll pour 300-lb heats of iron, nickel, and cobalt base alloys up to 3000 F



Press for the West

THIS 8000-TONNER, claimed to be the West's biggest hydraulic forging press is now in operation at Alcoa's Vernon, Calif, Works. The earthquake proof press has a 71-in. stroke, a pressing speed of 3 ips, turns out 500 sq in or bigger forgings

ASME Gets an Honorary Member

FIRST U S PRESIDENT SO HONORED WHILE IN OFFICE (President Hoover made it three years before he became President), President Eisenhower was named to honorary membership in the American Society of Mechanical Engineers in a ceremony at the White House April 23 for "continued application of engineering knowledge and skills" since graduating from a top engineering school, West Point. Commented the President to ASME President Joseph W Barker, "You even got my name spelled right . . . usually the first 'E' is missing . . . I guess I'm called Ike too often."

Sylacauga, Ala, closed since February, received a new lease on life from a $10-million government contract for manufacture of 155-mm shells . . . **Dixie Pipe & Foundry Co,** Pell City, Ala, is planning a major expansion program that will jump its payroll from 140 workers to almost 1000 and will bring the firm an anticipated annual business of nearly $30 million . . . Also expanding is **Alabama Engineering & Tool Co,** Huntsville, acquiring $175,000 in new machine tools this month to jump its output eightfold . . . Dade County, Fla, organized labor plans to build its own 150-bed hospital on five acres of land donated by an undisclosed city (not Miami) to accommodate the area's 70-80,000 union members . . . **Ingalls Shipbuilding Corp,** Pascagoula, Miss, is faced with an acute shortage of steel, partly because of supplier strikes. After fruitless appeals to the government for assistance, the firm is buying "used steel" and "premium steel" to meet commitments for barges and ships . . . Tullahoma, Tenn, is sweating out a decision from an undisclosed metalworking company that's considering putting up a plant there.

West . . .

Around the West . . .

Frank R Cook Co, Denver electronics firm, has a $151,600 contract to build 8000 radar reflectors for the Air Force . . . **Reliance Electric & Engineering Co** formally opened its West Coast plant at Burlingame, Calif, May 24 . . . Dr Gerhard R Fisher of Palo Alto's **Fisher Research Laboratory** is organizing a new firm to make electronic aviation equipment, plans to build a $1-million plant at Sunnyvale, Calif, by year's end . . . **Stromberg-Carlson** has opened a 22,000-sq-ft office-warehouse-and manufacturing facility in San Diego . . . **Sprague Engineering Corp,** maker of guided missile test equipment, is building a 76,000-sq-ft plant at Gardena, Calif . . . **Boeing Airplane Co** reports first quarter sales ran slightly under 1955's first quarter $191 million, but that its net increased slightly to $6.1 million . . . Edward J Horkey, ex-VP of Pastushin Aviation Corp, has formed his own aircraft research outfit, **Horkey Associates,** in Los Angeles . . . **Owen-Brink Co** has been formed in Seattle to act as agent for 12 manufacturers of fasteners and industrial hardware in the Pacific Northwest and Canada . . . **Carma Mfg Co's** tiny jet aircraft, the **WeeJet,** which crashed while being tested for commercial output, will be rebuilt in less than a year . . . **Convair** will build a $40-million plant near San Diego for manufacture of Atlas intercontinental ballistic missiles. It will operate autonomously — research, development, testing and manufacture—will have 6600 on the payroll by 1958. Convair already has several thousand enginers and other personnel doing spadework on Atlas in San Diego . . . **IBM** has opened its new electronic brain center in San Francisco, giving the Pacific Coast the largest concentration of electronic computers in the world. **Carrier Corp** will start construction this year of a $6-million air-conditioning and heating equipment plant in Puente, Calif . . . Also moving into Puente is **Imsley Corp,** Indianapolis maker of heavy construction equipment, and its subsidiary, Maxi Corp.

Marvin R Anderson (left) has been elected president of Michigan Tool Co; he succeeds **Oscar L Bard,** named chairman of the board. Mr Anderson, son of one of the founders of the company, and executive vice president for the past 12 years, has served as president of the American Gear Manufacturers Association for the last year. Mr Bard, president of Michigan Tool since 1940, has been associated with the company for the past 40 years

Eugene R Gardner, sales manager of the Textile Machinery Division of Warner & Swasey Co, has retired after 44 years of service with the company

Names in the News . . .

Robert S Ingersoll, an administrative vice president of Borg-Warner Corp, has been elected president of the corporation. He succeeds **Roy C Ingersoll,** re-elected board chairman, and named chief executive officer. **Lester G Porter,** an administrative vice president, has been named executive vice president.

J J Chyle, director of welding research, A O Smith Corp, Milwaukee, has been elected president of the American Welding Society. **Clarence P Sander,** general superintendent of the Vernon Plant of Consolidated Western Steel Division of US Steel Corp at Los Angeles, is 1st vice president, and **G O Hoglund,** head of the welding section of Alcoa Process Development Laboratory, New Kensington, Penna, is 2nd vice president.

Henry C Miller, sales manager of the milling machine department of US Industries' Axelson Division (*AM*—April 23 '56, p163), has been appointed machine tool sales manager of the Division. He will be in charge of national sales of Axelson lathes, as well as milling machines.

W P Snyder, Jr, board chairman of Crucible Steel Co of America, has retired as active head of the company. **Joel Hunter,** president for the past two years, has been named chief executive officer with responsibility for the general management of Crucible's activities. Mr Snyder will continue as chairman, acting in an advisory capacity.

Clarence G Rosensweig, executive vice president of Fafnir Bearing Co, New Britain, Conn, has been elected president. He succeeds **Stanley M Cooper,** named chairman of the board following the retirement of **Maurice Stanley. Richard F Cooper,** vice president and works manager, has been appointed vice president, manufacturing.

Henry M McAdoo, Jr, plant manager of Nice Ball Bearing Co, Philadelphia, Penna, has been promoted to vice president, manufacturing, following the retirement of **J E Mullen. John J Larkin** succeeds Mr McAdoo; **Thomas E Spence** has been named chief engineer.

Robert H Morse III, sales manager of Fairbanks-Morse, has been elected vice president, sales. **D L Harwood,** general purchasing agent, has been named vice president, purchases; **J F Weiffenbach,** chief product engineer is new director of engineering.

William E Bour, sales specialist in the Cleveland office of National Acme Co, has been named to the new post of manager of the firm's Threading Tools Division.

G W Trichel, executive vice president and general manager of Chrysler Corp's Amplex Division, has been appointed president. He succeeds **A J Langhammer,** who will act as a consultant until his retirement June 30.

E E McVeigh has been named manager of sales engineering for Baker-Raulang Co, Cleveland, Ohio, manufacturer of gas and electric materials handling trucks. He has been associated with the company for the past 16 years in sales and engineering capacities.

Clyde T Mooney, formerly vice president and general manager of Pioneer Engineering Co, Detroit, has joined Engineering Service, Inc, of America (Detroit) as president and general manager.

Douglas Graham has been appointed product manager of Elgin National Watch Co's Abrasives Division. Formerly cutter engineer for Ingersoll Milling Machine Co, Rockford, Ill, Mr Graham will be in charge of Elgin's new carbide tool program.

Thomas L Stilwell, assistant sales manager of Warner & Swasey Co's Textile Machinery Division, has been appointed sales manager. He succeeds **Eugene R Gardner** (above).

Charles M Kingsbury has been ap-appointed West Coast district manager for Kearney & Trecker Corp. He succeeds **Frank Riffle,** who has retired. **William Heim** of the Milwaukee service department, replaces Mr Kingsbury as resident service engineer in the Far West.

Carl J Siebert has been appointed sales manager of H K Porter Co's W-S Fittings Division, Roselle, NJ. He was previously district manager of the Chicago office.

John A Marsh, sales manager of the Air and Hydraulic Division of Rivett Lathe & Grinder, Inc, has been named vice president in charge of Air and Hydraulic sales

Robert G Keller has been appointed chief engineer of Lewis Welding & Engineering Corp's Machine Division

Leonard A Rafferty, assistant manager of the Pittsburgh office of Motch & Merryweather Machinery Co, has been appointed manager. He succeeds **J T McCuen,** who will continue as a sales consultant

Bart A Rossfeld, assistant vice president of American Brake Shoe Co's National Bearing Division, has been appointed vice president. **Albert L Hunt,** manager of industrial sales for National Bearing, has been named general manager of the division's St Louis plant.

Wade N Harris, executive vice president of Midland Steel Products Co, Detroit, has been elected president and chief executive officer. He succeeds **William A McKinley,** named to the newly-created post of chairman of the board.

Robert W Miller, specialist in the field of induction heating, has joined the Process Machinery Division of Cincinnati Milling Machine Co. He formerly headed his own business, specializing in automation for this type of equipment.

Paul Pick has been appointed chief engineer of the Allen Manufacturing Co, Hartford, Conn, producer of fasteners; he succeeds the late **Clarence S Gates.** Mr Pick moves up from the post of engineering project coordinator.

Stephen J Mueller, member of the sales department of Conveyor Systems, Inc, Chicago, has been appointed vice president, sales.

H C Mathey, vice president in charge of Pacific Coast operations for Liquid Carbonic Corp, Chicago, has been promoted to vice president, sales, of the corporation.

Frank Delaplane has been appointed manager of Kaiser Aluminum & Chemical Corp's forging plant at Erie, Penna. He was formerly production manager of the company's Halethorpe, Md, extrusion plant.

Earl Coté, general manager of Webb Forging Co, Belleville, Mich, has been named, in addition, vice president of the company.

Claud Fenn, head of Clark Equipment Co's plant at Buchanan, Mich, has, in addition, been named a vice president of the company.

John S Macdonald has been appointed general manager of General Electric Co's Distribution Assemblies Department, Plainville, Conn. He has been serving as manager of manufacturing operations services in the Manufacturing Services Division. **Andrew L Kozak** has been named superintendent, manufacturing, for GE's Gas Turbine Department, Schenectady, NY. He was formerly supervisor of factory production in the department's engineering section.

Frank W Godsey, Jr, manager of Westinghouse Electric Corp's Electronics X-Ray and Air Arm Divisions, has been elected a vice president of the company. Also named vice presidents are **A M Kennedy, Jr,** director of purchases; **F M Sloan,** general manager of the Lamp Division; **W Waits Smith,** manager of the Aviation Gas Turbine Division. All of the new executives will continue to direct their respective divisions.

Marshall H Boden, manager of General Motors' Buick-Oldsmobile-Pontiac plant in Linden, NJ, has been named manager of the assembly plant to be built in Sunnyvale, Calif. **Cornelius P Blay,** director of standards for B-O-P in Detroit, takes over the Linden post.

Charles Streck has been appointed factory manager of Copeland Refrigeration Corp's (Sidney, Ohio) compressor manufacturing operations. Prior to joining Copeland he was factory manager of the Air-Craft Division of Hussmann Refrigerator Co, St Louis, Mo.

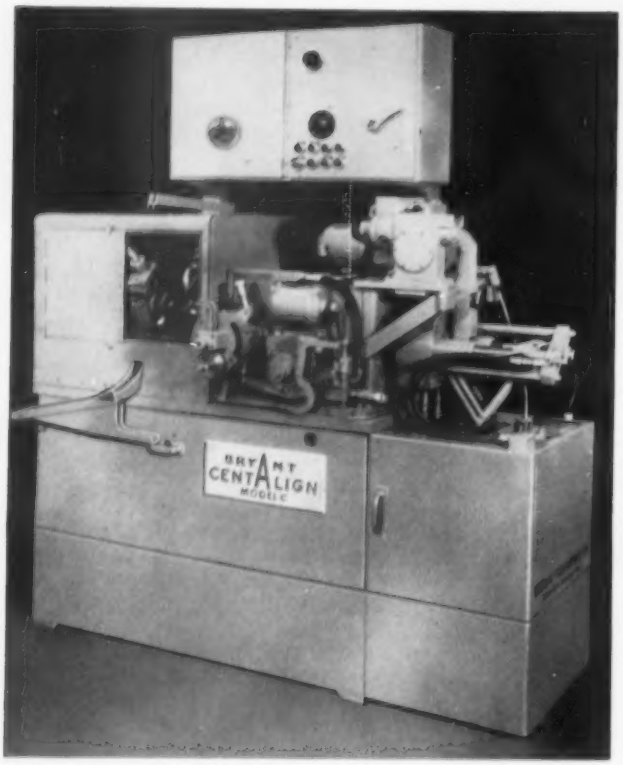
Leonard C Barr, vice president, sales, of Gregory Industries, Inc, Toledo, Ohio, manufacturer of Nelson stud welding equipment, has been named vice president and director of operations. **Robert C Singleton,** manager of industrial sales, has been appointed vice president, engineering. **Gene P Hopkins,** general works manager, has been promoted to vice president, manufacturing.

OBITUARIES

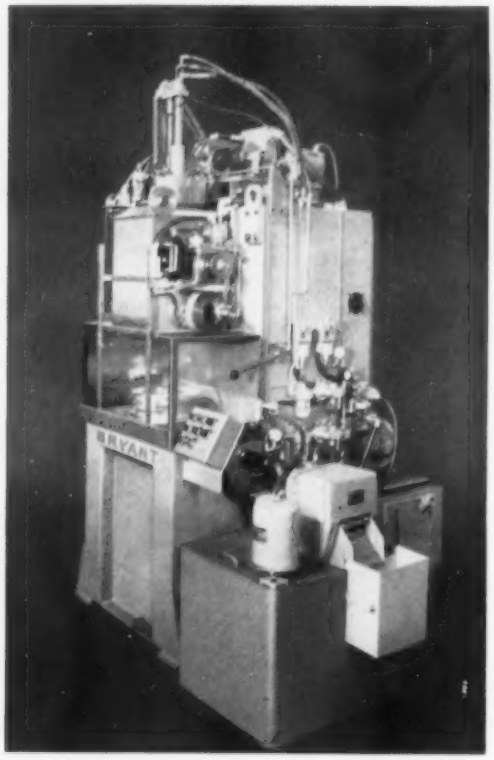
Herbert B Sabin, 91, founder and former head of the Sabin Machine Co, Cleveland, Ohio, contract machining firm, died May 2.

Nels E Flodin, manager of the Latrobe, Penna plant of Alco Products Inc, died April 29.

John H Poll, director of sales of Royal Master, Inc, Riverdale, NJ, manufacturer of centerless grinders, died April 9.



GUARDS HAVE BEEN REMOVED to show new wheelslide on horizontal unit



VERTICAL MODEL incorporates special low-mass chuck

Bryant Centalign Automatic Internal Grinder Has New Principles

Centalign automatic internal grinders, vertical or horizontal, combine several new principles, including longitudinal and cross motions of the wheelslide in the same plane as the wheel axis, fabricated bed incorporating vibration-absorbing elements, programming cams in interchangeable and storable groups, and much lighter cam levers controlling only while servos move units. Results indicate that jobs can be ground 20 to 50% faster than on earlier models—on one hydraulic-pump part, a 2-lobed bore is ground at 120 per hr with hand loading on a special vertical version of this machine, compared with 30 per hr on the older 1120-Y. In this case, speed is gained from a simplified, low-mass chuck that permits workhead-speed increases from 20 to 100 rpm.

First size to be built has 10-in. swing and 1-in. grinding stroke (adjustable during operation from 1/16 to 1 in.) to handle long run high-production grinding of bearing raceways, taper bores, and the like. Because programming cam sets can be interchanged (and stored) as units, however, recurring short-run operations are feasible.

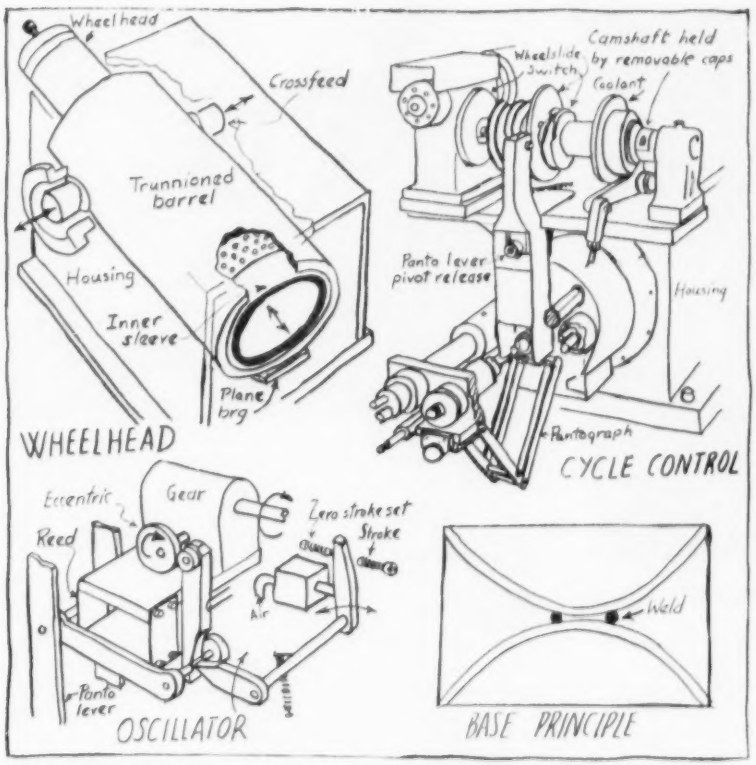
Stroking motion of the wheelslide is provided by a large sleeve carrying the wheelhead and moving in preloaded balls within a cylinder. The cylinder has trunnions near the wheelhead end, running in preloaded balls in a rigid-box, sealed housing. The rear of the cylinder is supported by a plane ball slide. Wheelslide actuation is from a simplified servo-controlled hydraulic system, so that control is by cam and much-lightened levers, while power is provided by servos. Cams are above the rear end of the wheelslide.

Cross feed of ¾ in. is applied by power screw at adjustable rates, and can be applied by hand during set-up. Feed and compensating-feed screws are incorporated in the trunnions.

Direct alignment of motions avoids any tendency for deflection, and the vibration-absorbing bed gives inherent stability which permits extremely close size control from the wheel-truing diamond. "Trend" gages and feedback control can be applied as a special if required, and automatic-plug or air gaging can also be used, but are usually not necessary.

Series 800 Bryant automatic wheelheads are cooled from the machine coolant system, and mist lubricated. Wheelheads are removable as units, and have automatic couplings for power, coolant, and lubrication. The workhead, on the other

Materials and Parts . . .



NEW DESIGN PRINCIPLES are involved in the Centalign machine

hand, is firmly attached to the base on the standard version. It can be positioned longitudinally for wheel stroke and can be swivelled for taper-bore grinding. Spindle runs in preloaded super-precision ball-bearings, fog-lubricated.

The all-fabricated bed is relatively light in weight, but has special design to take vibration down through diagonal members and absorb it. Design is a modification of that which won the Lincoln arc-welding award in 1955. Shoe-centerless fixtures are particularly usable on this machine. Two are standard, the larger able to hold work up to 4-in. OD, the smaller to 2-in. OD. Interchangeable shoes and work drivers adapt either to a variety of work. Loading and unloading are automatic, so that machine can be used in transfer lines. Special or other standard chucks can be furnished to suit the job.

Bryant Chucking Grinder Co, Springfield, Vt

SPECIAL CHUCK FOR VERTICAL UNIT is of low mass. Hand-loaded, it holds pump cams for internal-lobe grinding at 120 per hr, four times previous rates. Stock removal is 0.015 to 0.020 in. Plastic guards must be closed to actuate grinding cycle

. . . including

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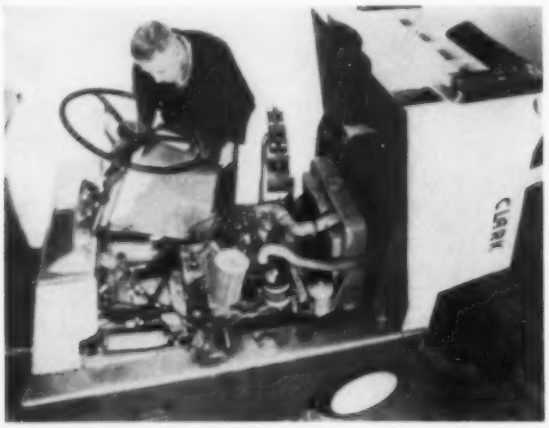
Materials Handling Institute's Exposition

Cleveland, June 5 to 8, 1956

Industrial trucks and attachments dominate the new materials-handling equipment introduced at the Show. These pages summarize new equipment recently introduced and not previously described in American Machinist



FORK-TRUCK MAINTENANCE is simplified by accessibility provided by spring-balanced, one-piece hood. Tray-mounted battery swings away from engine, and floorplate can be quickly removed

TWO INDEPENDENT BRAKING SYSTEMS on Clarklift truck increase operator safety, are said to provide 55% more effective stopping power than brakes on conventional models

Clark Introduces New Fork-Truck Line

Line designated Clarklift has features that emphasize safety, operator comfort, easy maintenance, greater maneuverability, and speedier operation. Current automotive trends are reflected by the inclusion of a 12-v electrical system, fully automatic transmission, emergency fuel tanks, foam-rubber seats, and automobile-like controls as standard equipment. Other features are self-adjusting brakes, spring-balanced swing-up hood for easy access to engine and battery, solid-tire models with drive and steer wheels of the same diameter, combination lift-tilt controls on steering column, and optional radiator screens for dusty operations.

Pneumatic-tire models designed for all-weather outside work are also included in the Clarklift line. Called Super Yardlifts, these models have more powerful engines, with a full-load speed of 12 mph and gradeability of 26 to 33%. Tubeless, high-flotation, deep-width tires are available with pressures of 30 or 75 psi and are interchangeable on each model.

Solid-tire models have a minimum full-load speed of 8 mph and a gradeability of 20 to 30%. Lifting speeds are about 50% greater than on conventional models, and heights reached go to 300 in. Gas-engine models with capacities ranging from 2000 to 5000 lb are available; electric models, as well as gas models of greater capacity, are to be added to the line in the future.

Uprights are made of chrome-alloy steel and have less than half the lateral deflection of those in older models; lifting force required is 30% less. Roller mounted, uprights are nested by means of telescoping sections to increase vision. Hydraulic system of 2000 psi includes a special valve in the tilting circuit to eliminate the possibility of a vacuum being formed in the back of the hydraulic cylinder, causing sway and loss of control over uprights.

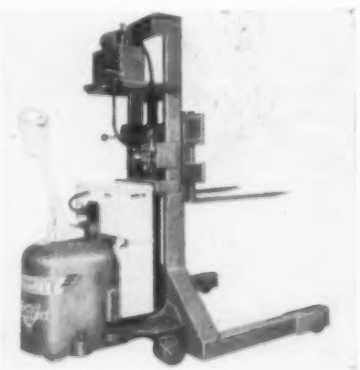
All-purpose forks with 22- to 30-in. taper and beveled tips allow pick-up of materials directly from floor. Power train combined with axle and brake permits non-stop forward-reverse shifting and delicate control of both full-load and no-load inching operations.

Clark Equipment Co, Industrial Truck Div, Battle Creek, Mich

Straddle-Type Pallet Truck For Heavy Load Handling

Barrett Model STF40 Hi-Lift electric truck is a battery-powered, walking-operator unit for double or single faced pallets.

Features include lesser weight, claimed to be half that of conventional truck of similar capacity; greater stability without counterweighting due to the fact that there are four wheels on floor at all times —load wheels and heavy duty outrigger casters; floating head pre-



cludes any weight being transmitted to the drive wheels. Easier traction is assured; floating or articulated head operates like a tractor pulling a trailer with no weight on driving mechanism.

Standard model has capacity of 4000 lb; overall height is 83 in., fork elevation, 68 in. In telescopic mast unit, fork elevation up to 131 in. can be provided.

Barrett-Cravens Co, Northbrook, Ill.

Portable Hand Crane

Designed for die handling, maintenance, or general shop work, portable hand crane has a capacity of 250 lb with a lifting height of 5½ ft. Boom is 25 in. long, and over-all height of crane is 6 ft 8 in.

Unit is equipped with 6-in. swivel casters on front and 7-in. rear wheels. Single foot-operated floor lock holds crane in a stationary position. Arc-welded frame with tubular bracing provides stability and rigidity. Planetary gear winch provides safety for cranking loads up or down. Direct cable pull is 600 lb and each revolution of the crank winds up 6 in. of cable.

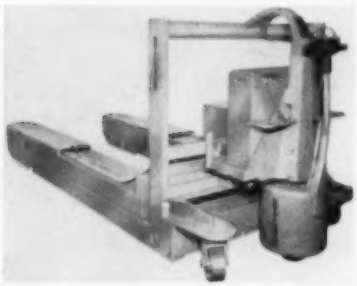
Lewis-Shepard Products, Inc, Watertown, Mass

Hand Lift Truck

Closed-end hand lift truck for handling loads up to 3000 lb eliminates forks, is designed to handle pallets without center runners. Unit is furnished in widths of 16, 18, 22, 24, and 27 in. Front wheels are 8-in. diameter and load wheels 3¼ in. All wheels employ ball bearings, and are available in semi-steel, rubber, plastic, and aluminum. Truck may be furnished with tandem-articulated load wheels for rough floors, and booster wheels can be added to handle double-faced pallets.

Hydraulic system, steering mechanism, and running gear are all standard, integrated components. Platforms up to 72 in. in length are available.

Market Forge Co, Everett, Mass

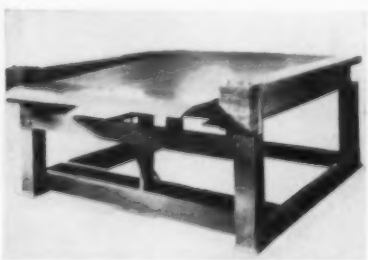


Large-Capacity Electric Truck

Designed to transport large bulky loads which rest directly on the floor, special JackLift electric truck has a capacity of 16,000 lb. Lifting arms straddle the loads to be picked up. Retractable fingers in the arms of the truck are then extended into slots in the load. When these are engaged, load is then lifted for transportation. Fingers are hydraulically operated and controlled from operator's position.

Drive unit is articulated so that the load-carrying frame is supported on all four corners by its rear wheels and stabilizing casters. Lifting arms are 57 in. wide and 84 in. long, and the open-end clearance between arms is 29½ in. Truck has a lift of 4 in.

Lewis-Shepard Products, Inc, Dept R-14, Watertown, Mass



Hydraulic Dock Leveling Device Available as Packaged Unit

Packaged unit is delivered completely assembled for placement in front of an existing dock.

The 20,000-lb-capacity model (available also in 10,000-lb capacity) is 6 ft wide by 8 ft 8 in. long. Instant raising or lowering action is controlled from a pushbutton station. Manual floating feature provides a smooth, level ramp which automatically compensates for spring deflection of truck bed during freight transfer. Leveler has its own hydraulic power unit consisting of a ½-hp, 115/220-v, single-phase, 60-c, totally enclosed, ball bearing motor, and a hydraulic package unit.

Rowe Methods, Inc, 2534 Detroit Ave, Cleveland 13, Ohio

Lewis-Shepard Introduces LoadMaster Fork-Truck Line

Designated LoadMaster Model R line, fork-lift trucks are available in capacities of 1500, 2000, 3000, and 4000 lb, featuring compact construction and minimum turning radii. Trucks will right-angle stack 40-in.-long loads in aisles 114⅝ in. wide and 48-in.-long loads in aisles 120⅝ in. wide. Turning radius is 62¼ in. Over-all length with 36-in.-long forks is 110⅝ in. and over-all width is 36 in.

Drive unit is gear drive powered by a compound-wound traction motor. Truck has four speeds forward and reverse with timed acceleration and dynamic braking. Traction speed is 5½ to 6 mph empty and, with a 4000-lb load, 5 to 5½ mph.

Elevating assembly consists of reinforced, formed-channel outer mast and rolled I-beam inner mast for greater rigidity. Hydraulic system gives fast lift speeds: on 3000-lb model, speeds are 48 fpm empty and 38 fpm loaded.

Lift height for an 83-in. collapsed height is 132 in. on 1500- and 2000-lb trucks and 130 in. on 3000- and 4000-lb models. Mast tilts in 10° and out 3°. Other features: Sealed bearings are used throughout; "deadman" brake is located on operator's seat.

Lewis-Shepard Products, Inc, Dept R-20, Watertown, Mass

Manually Operated Hydraulic Lift

Model LT-500 Crown E-Z Lift, designed as companion model of previously announced 1000-lb model, elevates loads up to 500 lb to any height between 4½ and 54 in. above the floor. Lift is equipped with a safety overload release set to refuse loads of more than 600 lb.

Hydraulic lifting mechanism is operated by a detachable handle located at a convenient height above floor. Constructed of tubular steel, unit is 64 in. high, 22¼ in. wide, and 31 in. long, weighs only 200 lb. Platform is 22 in. square, and straddle capacity is 16½ in.

Crown Controls Co, Inc, 40-44 S Washington, New Bremen, Ohio

THREE-WHEEL MOTOR SCOOTER imported from Italy is equipped with open pickup body capable of a 600-lb load. Barely over five feet long, scooter has speed of 35 mph, is reported to travel up to 85 miles on 1 gal of gas—*Imported by Lambretta Div, Innocenti Corp, 45 Columbus Ave, New York, NY*

GS-Approved Gas Trucks Work In Hazardous Locations

Yale KG-51 line of gas-powered industrial lift trucks has been fitted to fulfill safe-usage requirements spelled out for locations listed in GS code in parts of Class I, Division II; Class II, Division II; and all of Class III, Division III. Trucks range from 3000 to 10,000 lb in capacity.

In addition to spark-arresting muffler and non-siphoning, suction-fed fuel system, line incorporates specially designed exhaust flame arrester made up of 64 finely separated stainless-steel plates. Generator and battery cutout switch are easily accessible to operator, so that circuit can be broken in case of emergency.

Other features include totally enclosed generator and starting motor, shielded fuel fill cap, protected gas tank, covered battery terminals, rubber boots over all electrical terminals, and flame-arresting air cleaner.

Yale Materials Handling Div, Yale & Towne Mfg Co, 11,000 Roosevelt Blvd, Philadelphia 15, Penna

Telescoping Portable Lift

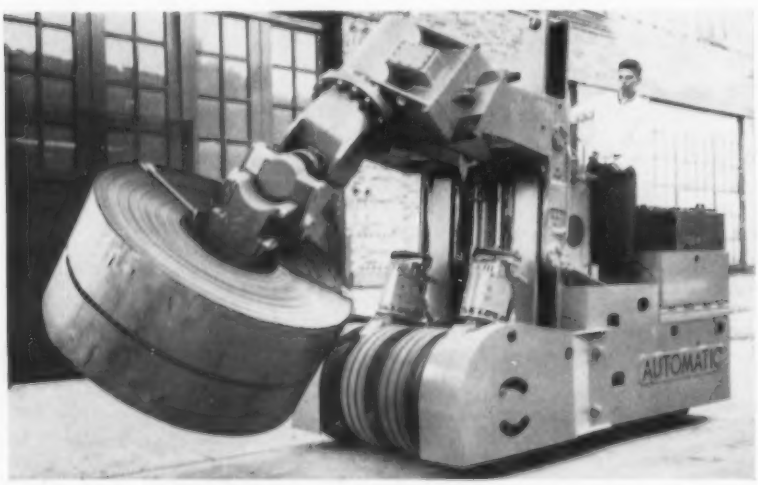
Designed for high stacking operations, 112-in. telescoping lift combines mechanized raising and lowering of loads with non-powered horizontal transportation. Model, designated L1112-P, has a 1000-lb capacity and a battery-powered hydraulic lift.

Other specifications: load center, 15 in.; power rate, 33½ fpm at no load, 21½ fpm loaded; straddle capacity, 30 in.; turning radius, 60 in.; over-all height collapsed, 78¼ in.; over-all width, 37 in.; over-all length 52 in.

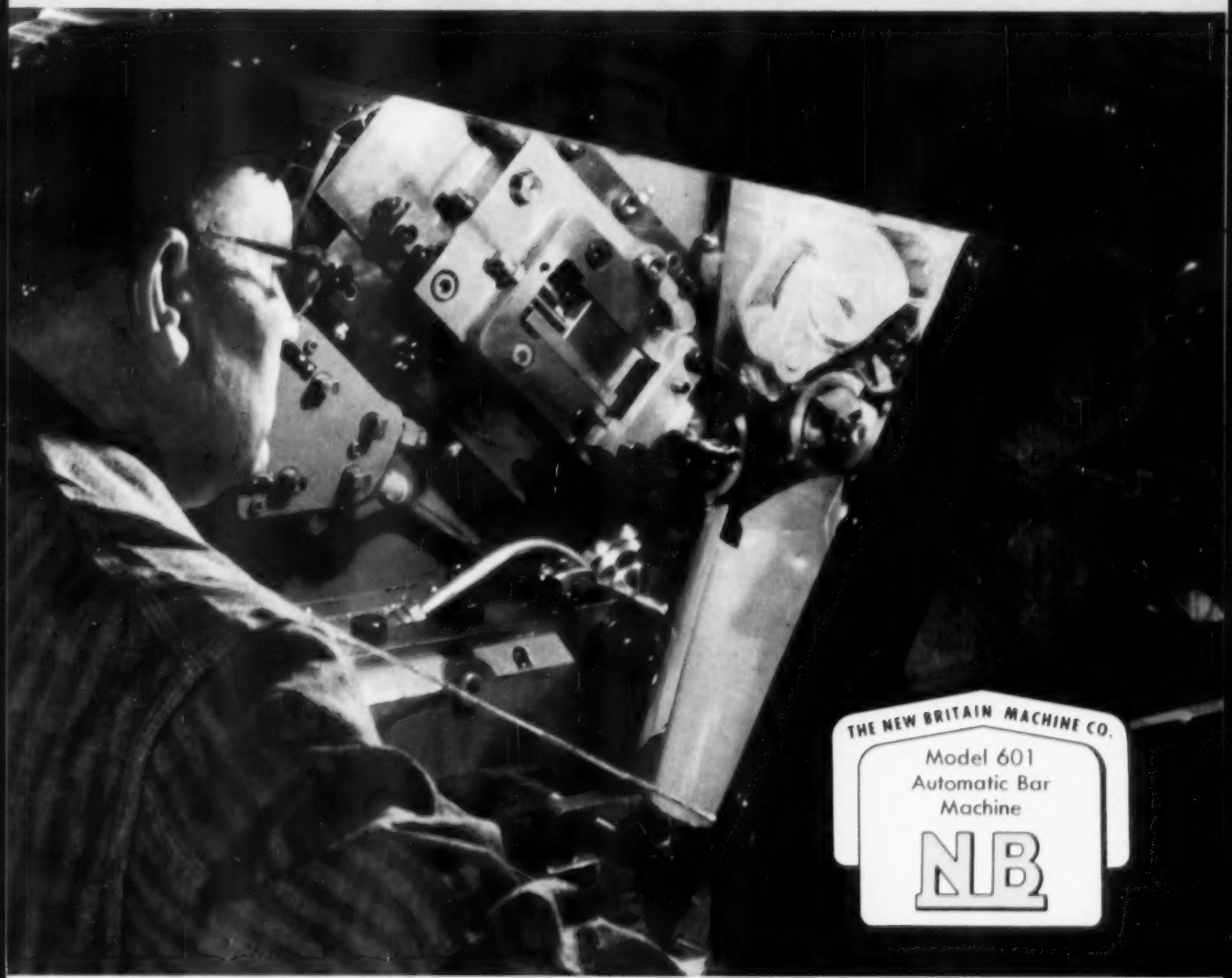
Oster Mfg Co, Box 4326, Cleveland 32, Ohio

Flex-O loading dock bumpers, constructed of weather-proof, reversible, rubber-coated fabric, are available in four sizes with standard lengths of 14 and 36 in., and standard thickness of 4½ in. They are designed to cover a facing depth of either 6, 9, or 12 in. They can be bolted to wooden docks, welded to steel plates, or lagged to concrete facings.

Bumpers, Inc, 2534 Detroit Ave, Cleveland 13, Ohio

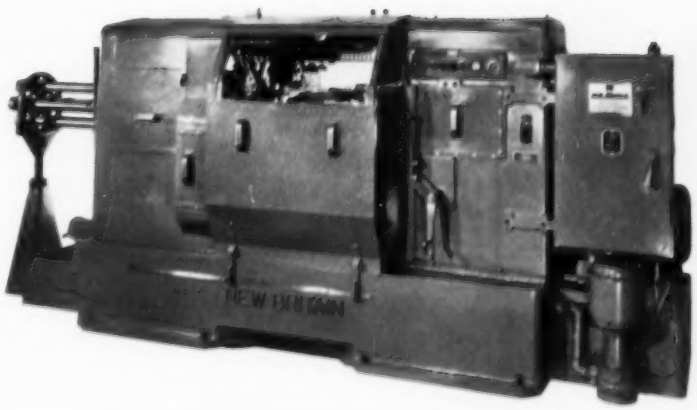


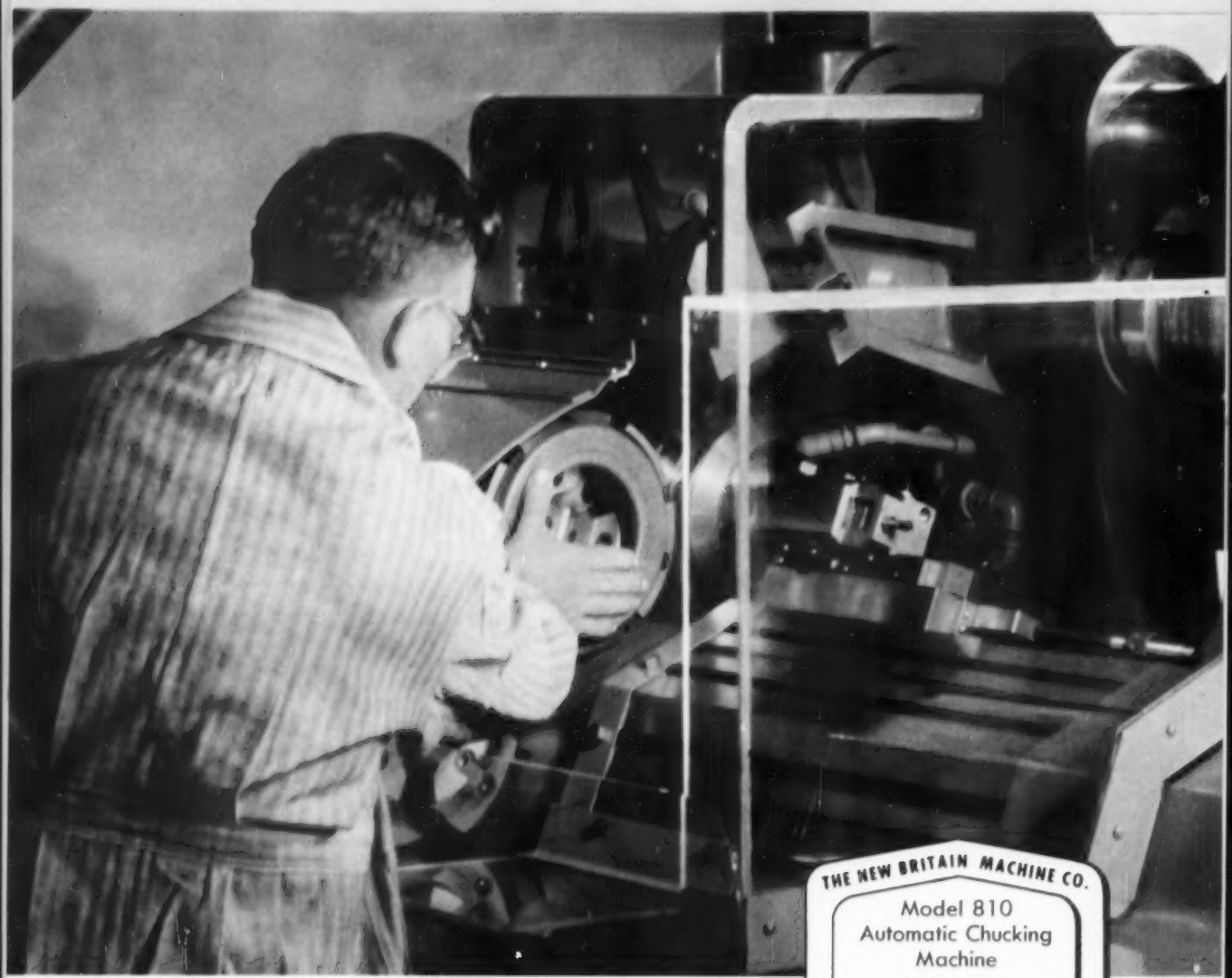
COIL-LIFTING ATTACHMENT for heavy ram truck can pick up a 60,000-lb steel coil in either horizontal or vertical position and rotate it to the opposite position. Available on Automatic's HR series electric trucks, attachment consists of 90° rotator offset approximately 45° from the vertical. Clamp and ram unit hold coil securely during rotation, preventing it from telescoping. All operating controls are located in operator's position, and attachment may be removed for installation of forks or ram—*Automatic Transportation Co, 149 W 87th St, Chicago 20, Ill*



8 tons of metalworking efficiency

If you are interested in absolute minimum cost per piece on either long or short runs, investigate the Model 601 New Britain bar machine. Massive enough and powerful enough to handle your new high-speed cutting requirements. Super-high spindle speeds, maximum versatility, optional universal tool slide cam which eliminates cam change time. With the Model 601 on your floor you have "the shortest distance" between bar stock and finished piece. Write for Bulletin 6H.



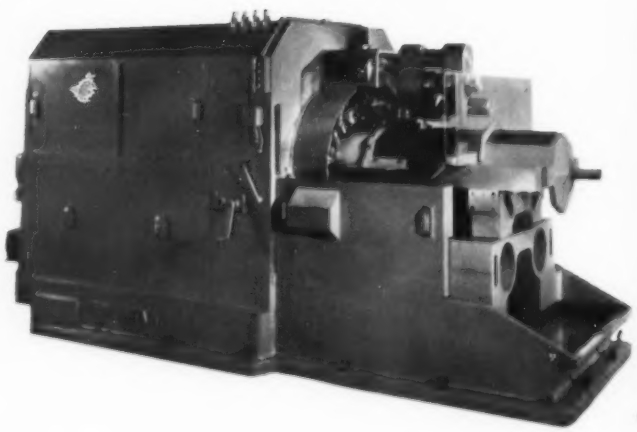


new New Britain chuckers handle bigger work pieces

If you know chucking machines you know the world-wide reputation of New Britains for accessibility, versatility, quick setup and sustained high production of precision parts.

Now new New Britain models enable you to apply this high productivity to pieces with chucking diameters up to ten inches on eight-spindle machines, twelve inches on six-spindle production and fifteen inches on four-spindle work.

Check this practical approach to more profitable production with your New Britain representative, or write for Bulletin 3R. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



FYI FOR YOUR INFORMATION

FREE Catalogs, Booklets, Charts, Calculators

FYI—these initials symbolize information that's important. And there is much of importance in the literature listed here. To get the ones you need, all you do is fill out one coupon for each booklet you wish to order. Indicate in the circle on the coupon the number of one catalog wanted. When you have filled out a card, detach, stamp, and mail. We'll do the rest.

MACHINES AND ATTACHMENTS

1 THREADING MACHINES—*Landis Machine Co, Waynesboro, Penna.* 20-page bulletin H-76-2 contains illustrated information on Model C Landmaco machines for heavy duty or precision threading. 5 sizes cover range of from ¼ to 2½ in., either single or double spindle. Includes construction, design, operational features, and specifications.

2 PRESSES—*Clearing Machine Corp, Chicago 38, Ill.* 36-page bulletin 233 discusses factors involved in proper selection. Variety of units illustrated for range of applications; design and construction features outlined.

3 SURFACE GRINDER—*Abrasive Machine Tool Co, East Providence, RI.* 8-page catalog illustrates and describes No. 1½ (10 x 15-in.) hand-feed precision unit with 7-in. grinding wheel equipment. Design features and available attachments covered.

4 3-DIMENSION TRACER MILLING UNIT—*Sundstrand Machine Tool Co, Rockford, Ill.* 4-page illustrated form 3D-1 describes model for taking numerous cuts on large work by moving cutter instead of work. Self-contained unit can be moved to different positions to make intricate cuts in transverse, longitudinal, or vertical directions. Dimensions included.

5 SLITTING MACHINES—*Yoder Co, Cleveland 2, Ohio.* 76-page indexed, revised catalog contains detailed, illustrated data on slitting lines for coils and sheets. Part I covers basic information on design, selection, operation, including time studies and analysis of operating cycle, coil handling, scrap disposal methods. Part II covers specifications, tabular data on variety of units. Applications discussed.

6 ROTARY GEAR SHAVING MACHINES—*National Broach & Machine Co, Detroit 13, Mich.* 12-page catalog S-56-1 illustrates and describes Red Ring Model GCI units for shaving external or internal spur and helical gears by conventional shaving process. Specification tables for three standard and three special. Variety of applications included.

7 FOLDERS & BRAKES—*Niagara Machine & Tool Works, Buffalo 11, NY.* 8-page bulletin 74C covers air-actuated and hand-operated models. Adjustable bar folders, foot brakes, and universal folders and brakes are illustrated and described with specifications.

8 HYDRAULIC TURRET DRIVE—*A W Cash Co, Decatur, Ill.* 5-page bulletin S-740 gives illustrated data on Cash standard unit for powering ram-type hand turret lathes Nos. 1, 2, 3, 4, and 5. Advantages and features covered, specifications detailed.

TOOLS AND ACCESSORIES

9 COOLANTS—*F E Anderson Oil Co, Portland, Conn.* 16-page illustrated catalog covers Lusol line of water-based products for machining, grinding, rolling, drawing, forming, and stamping. Properties and uses described.

10 TOOLING IDEAS—*Wilton Tool Mfg Co, Schiller Park, Ill.* 48-page illustrated catalog discusses tooling ideas applied to automation. New powered clamping tools, methods, and line of 250 devices described. Applications, performance charts, specifications included.

11 MECHANICAL FORCE GAGE—*W C Dillon & Co, Van Nuys, Calif.* 6-page brochure describes Model X for precision measurement of pressure, tensile or torque. Instrument which checks loads even in very limited space may be used alone or can be incorporated directly in special testing devices. Wide variety of applications illustrated, dimensions tabulated.

12 ELECTRIC TOOLS—*Thor Power Tool Co, Aurora, Ill.* 44-page catalog contains illustrated information on Silver Line and Speed Tool units including No. 56 SpeedWrench; No. 568 right-angle attachment for ½-in. square-drive air or electric impact wrenches; No. 15T SpeedSander; No. 567 Saber-Saw attachment; and No. 475 SpeedSaw.

13 SWISS PRECISION FILES—*Grobet File Co of America, Inc, Carlstadt, NJ.* 8-page illustrated brochure 356 illustrates use of hand files on production line. Specifications for wide variety of files included.

14 TUKON HARDNESS TESTERS—*Wilson Mechanical Instrument Div, American Chain & Cable Co, Bridgeport 2,*

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FYI
FOR YOUR INFORMATION

Conn. 12-page bulletin DH-328 describes functions of units for micro and macro hardness testing of metallic and non-metallic parts. 3 models illustrated with listing of vertical capacities, load in grams, weight in pounds; principle of applications covered.

15 'DAG' DISPERSIONS—*Acheson Colloids Co, Div of Acheson Industries, Inc, Port Huron, Mich.* 5th revision of 4-page booklet lists 41 colloidal and semi-colloidal dispersions for operational functions, maintenance, lubrication, machine design, and other industrial applications. Carriers and diluents given for each product, with applications and physical data.

16 AUTOMATIC GAGING SYSTEMS—*Federal Products Corp, Providence 1, RI.* 25-page illustrated catalog 56 AM explains four systems used for automatic control: electric, air-electric, electronic, and air-electronic, with components of each. Covers types of control gaging for automation, such as on-the-machine, after-the-machine, continuous process, and others.

HEAT-TREATING AND WELDING

17 SIMPLIFIED WELDING PROCEDURES—*Eutectic Welding Alloys Corp, Flushing 58, NY.* 140-page pocket data book TIS 2575 describes procedures for every base metal; covers 120 welding rods, electrodes, and welding compounds.

18 PRECISION FLAME MACHINING—*Seaman-Andwall Corp, Cogmatic Div, Milwaukee 1, Wis.* 8-page booklet illustrates and describes Cogmatic process for producing large sprockets and gears automatically, involving precise control of a fast-cutting torch. Automatic unit can machine any size up to 100-in.-dia, and up to 3 in. thick.

19 RESISTANCE WELDERS—*Precision Welder & Flexopress Corp, Cincinnati 9, Ohio.* 6-page illustrated bulletin G-100 covers complete line including standard and semi-standard, and specials for unusual production problems.

PLANT SERVICE EQUIPMENT

20 ELECTROSTATIC SPRAY PAINTING — *Ransburg Electro-Coating Corp, Indianapolis 7, Ind.* 16-page brochure contains illustrated data on No. 2 Process for finishing products ranging in size from automobile chassis to door knobs. Variety of units and applications pictured and described.

21 GRAVITY ROLLER CONVEYORS—*Harry J Ferguson Co, Jenkintown, Penna.* 20-page bulletin 100 pictures and describes complete line including standard and specialty items.

22 ELECTROLYTIC PLATING — *Neotronic Corp, Chicago 18, Ill.* 10-page brochure explains Neo-Chrome process for chromium plating any base metal or alloy through use of combination of micro short waves with direct current. Advantages of method as against conventional plating illustrated and described.

23 MATERIAL HANDLING & SHOP EQUIPMENT—*Bathey Manufacturing Co, Plymouth, Mich.* Catalog folder consists of 4 illustrated bulletins describing pan and adapter work-station and storage system; modular system for work-station and storage of small parts; bench models of bin equipment; and floor units.

24 CRANES—*Dominion Bridge Co, Ltd, Montreal.* 40-page handbook M-100 contains illustrated data on electric overhead travelling cranes and other handling equipment. Covers classification of cranes, runways, electrical equipment, accessories.

25 AUTOMATED DATA PROCESSING—*Dashew Business Machines, Culver City, Calif.* 20-page brochure presents illustrated description of equipment for data processing on selfwriting metal identification tags and applications for linking office/factory systems to control production, storage, inventory, shipping, and receiving. Covers Databosser, Dashaplates and other writing and marking tools.

PARTS AND MATERIALS

● "CASTING ALUMINUM" — *Reynolds Metals Co, 2500 S Third St, Louisville, Ky.* 130-page illustrated technical handbook contains detailed information for selection of casting process and alloy best suited to meet product requirements. Includes data on typical mechanical properties; alloy classifications and characteristics; fluxes; trimming, cleaning, heat-treatment, machining; tabular data on recommended cuts, feeds, speeds. Request direct on company letterhead.

26 VARIABLE SPEED TEXROPE DRIVES — *Allis-Chalmers Manufacturing Co, Milwaukee, Wis.* 44-page illustrated booklet 20P50 contains selection tables for A, B, C, and D section drives. Data on design features, drive principles, hp-rating tables for A, B, C, D, and E section belts, speed range table, accessory equipment included.

27 HYDRAULIC STRAIGHT THREAD FITTINGS—*L & L Manufacturing Co, Van Dyke, Mich.* 24-page catalog ST-56 describes three new sealing applications on straight thread fittings. Includes 45 different fitting illustrations with specification charts on sizes, part numbers, and dimensional information.

28 HIGH-SPEED INDEXING MECHANISMS—*Ferguson Machine & Tool Co, St Louis 21, Mo.* 24-page catalog 106 contains selection and application data. Includes methods of calculating load requirements, load ratings, and dimensions of stock and standard Ferguson Drives. Describes Trans-Pac, a standard packaged power unit for indexing straight line assembly machinery.

29 PRESS CONTROLS—*Danly Machine Specialties, Inc, Chicago 50, Ill.* 12-page illustrated catalog describes features and characteristics of controls designed and built specifically for operation of presses and press accessories, automatic feed devices, scrap cutters, etc.

MISCELLANEOUS

30 BLISS' FACILITIES — *E W Bliss Co, Canton, Ohio.* 46-page brochure 58 presents illustrated data on the six major product divisions: Government Contract, Press, Rolling Mill, Metalworking Roll, Can Machinery, and Die Supply. Typical products and components described; history, expansion, individual facilities.

31 "WORK SIMPLIFICATION ON FILM"—*Industrial Management Society, Chicago 1 Ill.* 12-page folder lists 38 films (16mm) available for rental; running time 10 to 15 minutes. Picture before and after operations of work simplification.

Continued on page 224

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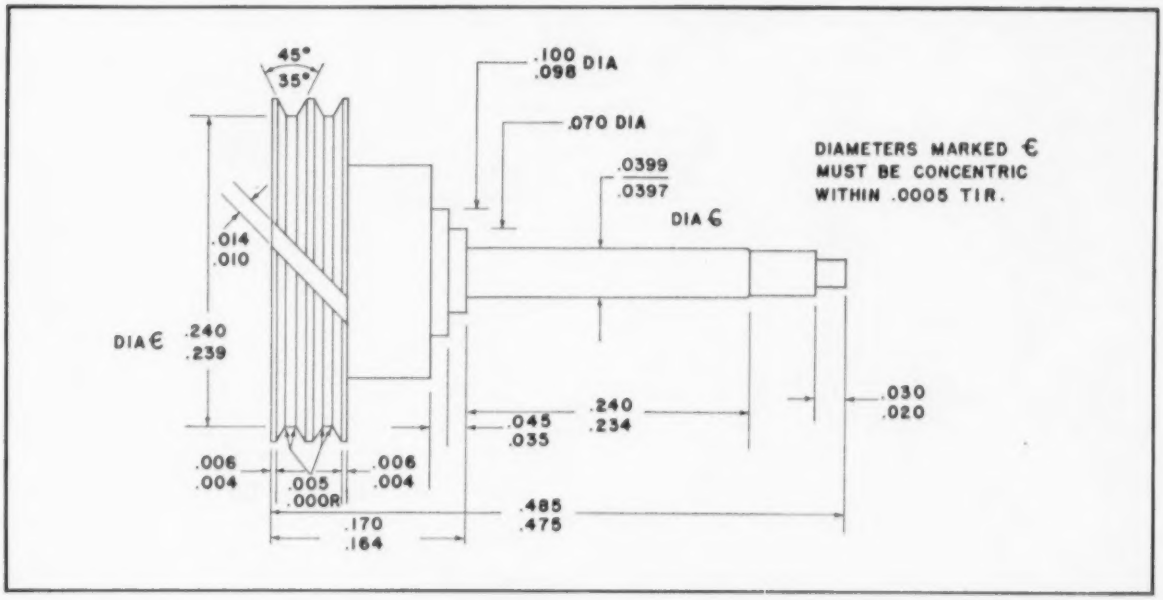

Five times as many parts checked per day... with a Kodak Contour Projector

Here's one company's approach to the problem of receiving inspection that may help you save time, improve accuracy.

TECHNOLOGY INSTRUMENT CORPORATION'S receiving inspection used to require 10 to 15 minutes each to check incoming precision shafts by mechanical gaging. Inspection involved concentricity, diameters, shoulder locations, and other hard-to-measure dimensions. Tolerances on these shafts—components of precision potentiometers—ranged from .002″ to .0002″.

Then they turned to optical gaging with a Kodak Contour Projector; inspection time was cut to 2 to 3 minutes per shaft.

Here, again, is proof of how a Kodak Contour Projector often speeds inspection of precision parts. Dimensions difficult or impossible to measure by mechanical methods frequently are easily checked using optical methods. And you can shift from one part to another simply by changing a fixture and chart-gage.

There's a Kodak Contour Projector for every inspection or measurement job, whether in the toolroom, in receiving, production, or final inspection. And there's a representative in your area who can evaluate your needs for you. To get in touch with him, or for a copy of the booklet "Kodak Contour Projectors," mail the coupon below.

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Electric Fork Truck

Model E electric fork-truck line, ranging in capacity from 1000 through 4000 lb, has been improved in many respects over older models. Features include new elevating assemblies, hydraulic systems, steering mechanisms and controls, and improvements in the brakes and drive axles.

Redesigned masts, consisting of heavy formed channel and I-beam sections, have lift of 132 in. for 83-in. mast height on the 1000, 1500, and 2000-lb trucks. On 3000 and 4000-lb models, lift is 130 in. for 83-in. collapsed height. Both fork carriage and telescoping section ride on ball-bearing rollers.

High-pressure hydraulic system operates at 2500 to 3200 psi, giving faster lift speeds with no increase in battery consumption. 2000-lb trucks have a lift speed of 55 fpm loaded and 65 fpm empty.

Lewis-Shepard, Watertown, Mass

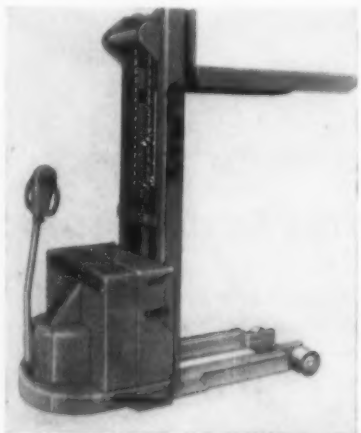
Yale Pallet Truck Features Simplified Maintenance

Worksaver pallet truck, available in 4000- and 6000-lb capacities, can be fitted with two different-size battery compartments: short model fits a 6-cell, 13-plate battery and is only 24 in. longer than the load; larger model takes a 6-cell, 25-plate battery and is 33 in. longer than load.

"Breakaway" feature incorporated into the truck permits whole front of truck to open away from the battery compartment by removal of two pins, one on each side of truck. Every hydraulic and mechanical unit is thereby immediately accessible for service. In addition, without any disassembly of the truck, the hoist motor can be pivoted forward into the battery compartment for easy cleaning or brush renewal.

Models have two speeds forward and two reverse, controlled by dual cams at fingertip reach from steering-handle crossbar. Design of elevating linkage using compression tubes mounted high in the pallet forks gives an underclearance of more than 5 in. for easier operation on ramps.

Yale Materials Handling Div, Yale & Towne Mfg Co, 11,000 Roosevelt Blvd, Philadelphia 15, Penna



High-Lift Platform Hand Truck

Battery-powered hand truck with capacity of 4000 lb, an addition to the Powrworker line, has a lifting height of 51½ through 70½ in. and a down height of 6½ or 10½ in. Designated the "Hi-Lift Platform," truck travels at 3 mph empty and 2.2 mph fully loaded, both in forward and reverse.

Full-load lifting speed is 9 fpm and lowering speed is 20 fpm. Brake is spring applied when steering handle is in vertical or horizontal position. As brake is applied a "dead man" switch is actuated which automatically breaks the power circuit, makit impossible to operate truck.

High-torque, series-wound drive motor is horizontally mounted and equipped with sealed ball bearings. 12-v battery is standard. Platform width is 26 in., and platform lengths are available in sizes of 36, 42, 48, 54, and 60 in. Standard over-all heights are 68 and 83 in., and over-all width is 32 in. Lock and electric horn are standard equipment.

Clark Equipment Co, Industrial Truck Div, Battle Creek, Mich

Single-Mast Lift Truck

Hyster Monomast lift truck, Model QN, now available with pneumatic tires, has 2000-lb capacity at 24-in. load centers. Single mast provides operator with full view of both forks and load from normal driving position.

Truck is powered by a heavy-duty air-cooled Wisconsin gas engine; LP-gas conversion kits are also available.

Complete line of Hyster hydraulic attachments can be readily mounted on the attachment carriage.

Hyster Co, 2902 NE Clackamas St, Portland 8, Ore

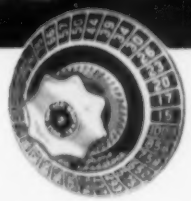
Mobilift Directional Controls Mounted on Steering Column

Model B-224, a 2000-lb capacity truck with direction control lever mounted on steering column, enables operator to make smooth starts or reverse direction without clutching, gear shifting, or removing either hand from the wheel. Additional features are hydraulic equalizing rear suspension system, double frame construction, and independent steer wheel suspension.

Powered by gasoline or LP-gas, unit turns within a 67-in. radius; operates up to 11.5 mph; lift speed loaded is 58 fpm.

Lamson Mobilift Corp, Syracuse, NY

SIDNEY DIAL-MASTER LATHE
MODEL 32



SIDNEY'S LATEST TRIUMPH IN MODERN TURNING

The proved and approved answer to industry's demand for a turning tool which answers practically every requirement for *fast, economical precision production.*

DIAL-MASTER offers:

- DIAL CONTROL — 32 pre-selective spindle speeds
- Increased capacity ● Added rigidity
- Increased size spindle diameter, tailstock, apron and carriage and bed design
- Simplified feed and thread control arrangement
- Single operational apron control lever for feed and quick traverse in four directions for maximum convenience of operator
- Complete range of 60 thread and feed changes

Also available with THE SIDNEY FLUID TRACER ATTACHMENT which provides tremendous savings in cost per finished piece on small or quantity runs. Tracer motor may be turned off while the machine is performing standard lathe work.

Write for new bulletins or ask for representative to call at your convenience

THE SIDNEY MACHINE TOOL CO.

Builders of Precision Machinery since 1904

Sidney, Ohio

Sit-Down Electric Lift Truck

Over-all length of Yale K-51-AT truck is only 67 in. to the face of the fork carriage, so that it can operate in aisles as narrow as 10½ ft wide. Truck is being introduced in a 4000-lb-capacity model.

With no load truck can run 6 to 6½ mph; under-load speeds of 5½ to 6 mph can be achieved. Loads can be lifted at speeds of from 25 to 30 fpm; empty forks can be raised at 45 to 50 fpm.

Added stability has been built into truck through the use of four carriage rollers bearing against the channels in addition to four channel-thrust rollers to resist off-center loading side-thrust. Load can be safely nested for travel by 11½° backward tilt. Channel can be tilted forward 5°.

Drive and pump motors are series wound with armature shafts mounted on ball bearings. Motors have silicone insulation for protection against high temperatures. Four forward-and-reverse speeds are controlled by company's Magnetic Cam-O-Tactor time-delay control.

Yale Materials Handling Div, Yale & Towne Mfg Co, 11,000 Roosevelt Blvd, Philadelphia 15, Penna

Rotating roll clamp developed by Lewis-Shepard will handle rolls from 24 to 48 in. in diameter in either the vertical or horizontal position. Clamp consists of 2 hydraulically operated arms which have a range of 22 in. minimum to 52 in. maximum. One is a short, thin arm containing an articulated rubber-lined pad; the other arm is longer and contains two articulated rubber-lined pads. This combination of arms enables operator to remove from storage rolls that are touching each other or touching a wall, by approaching them from an angle. Clamp, which attaches to company's industrial trucks, has full 360° rotation, accomplished by a system of chains and sprockets driven by a hydraulic motor.

Lewis-Shepard Products, Inc, Dept R-13, Watertown, Mass

ELECTRIC TRUCK, Model WST 20 in Transporter stacker series, has over-all height of 83 in., telescopic lift of 135 in., and load capacity of 2000 lb. Other models have load capacities ranging up to 4000 lb — *Automatic Transportation Co, Div of Yale & Towne Mfg Co, 149 W 87th St, Chicago 20, Ill*

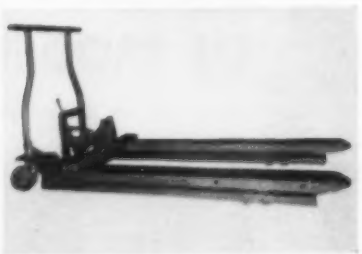
Mechanical Lift Truck Handles Cable Reels

Lewis-Shepard lift truck, designed for handling cable reels weighing up to 1000 lb, has lifting arms 36 in. long with an opening between forks of 22 in. Truck can handle reels varying in diameter from 17½ to 38 in. and up to 20 in. wide. Lift of 2 in. is obtained by pulling down on the handle; lowering is controlled by a foot pedal.

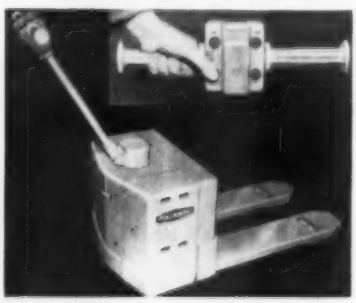
Each lifting arm is equipped with a sliding hook which rides on a diagonally located tube. Each hook has a spring-loaded clamp so that hook can be properly positioned for reel size by sliding it up or down on the diagonal tube.

Operator positions truck so that it straddles the reel. Then he raises the hooks until they engage a shaft which has been placed in the center of the reel. For transporting, handle is pulled down to lift the reel.

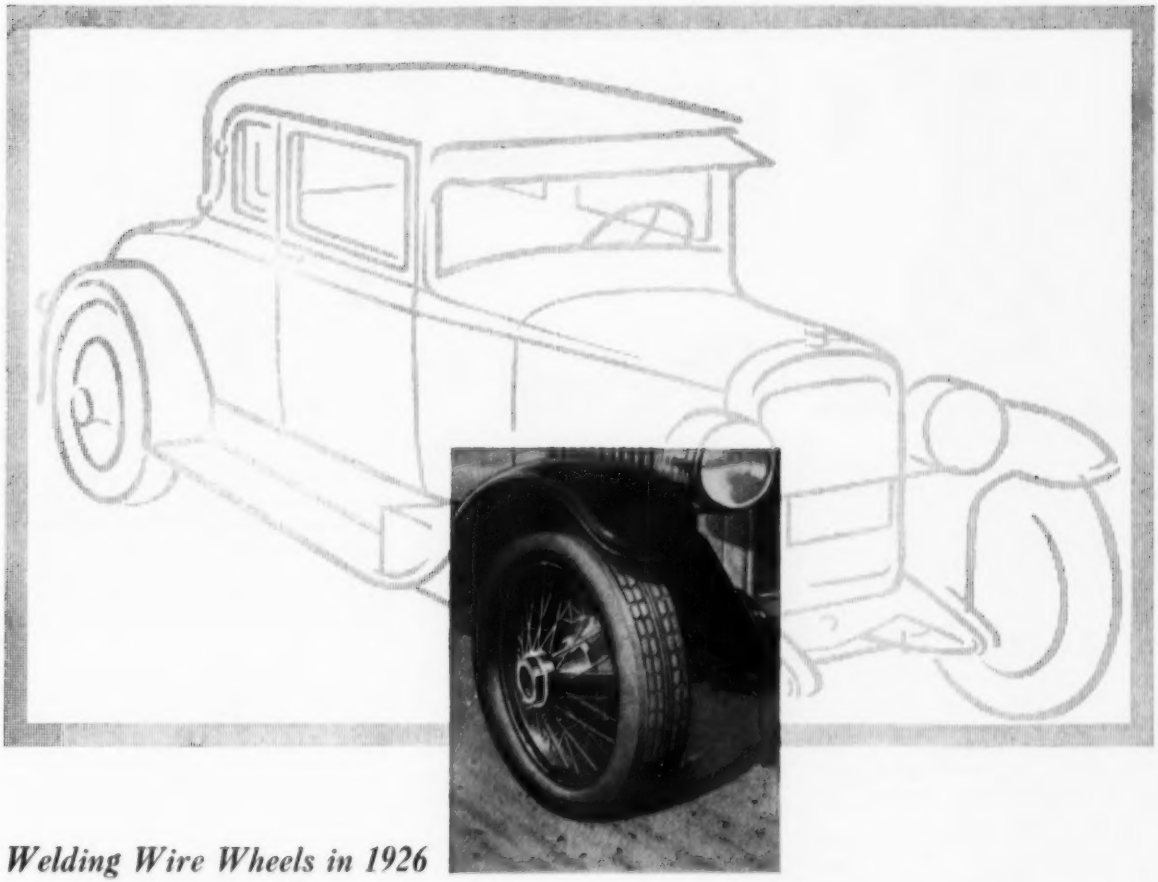
Lewis-Shepard Products, Inc, Dept R-13, Watertown, Mass



HYDRAULIC PALLET LIFT called General is available in improved model which incorporates foot-pedal lifting mechanism for raising forks from 3¼-in. lowered position to 5½-in. max lifting height. Load is raised to a level position by six lifting cams. Four-point suspension moves high loads without swaying, and tandem rear wheels prevent sticking in floor cracks. Lift has 2250-lb capacity, fork length of 54 in., and over-all width between forks of 30 in. — *Pallet Vault Corp, Dept 102, 625 Euclid Ave, St Louis 8, Mo*



"WALKIE" ELECTRIC TRUCK has over-all length only 20½ in. greater than load length, making model very maneuverable. Power pack of four automotive-type batteries provides 24-v operation with no resistance loss in 2nd and 3rd speeds. Special safety button on end of handle instantly puts truck into reverse direction when it presses against operator. Model has three travel speeds, is designed for pallet handling, and is offered in 4000-lb capacity—*Raymond Corp, 47-139 Madison St, Greene, NY*



Welding Wire Wheels in 1926

Helped MALLORY Learn Better Ways to Solve Your Welding Problems Today

THIRTY YEARS AGO, a leading auto manufacturer (still a leader today) ran into a serious production bottleneck in resistance welding of wire wheels. The copper dies being used wore out so quickly that costs were too high, production too slow.

Elkonite®, a material developed by Mallory, looked promising for this application. It was tried . . . and the results were excellent. Die life increased tenfold. And production was freed of stoppage troubles.

This development marked Mallory's entry into the resistance welding field. It has been followed, in succeeding years, by a continuous stream of contributions to welding technology. These are some of the major milestones in Mallory progress:

Specialized alloys, like Elkaloy® A, Mallory 3, Mallory 22 and many others, which provide a family of materials engineered for the specific needs of welding service.

Fluted electrodes, which greatly increase electrode life.

Cold forming methods for producing bent electrodes with greater hardness and strength.

Special holder designs to meet the needs for higher pressures for large welding machines, and low pressures for non-ferrous alloys.

The knowledge gained during three decades of pioneering activity and constant development stands ready to serve on your own resistance welding problems. Write or call Mallory for a personal consultation by a Mallory welding engineer . . . and see your local Mallory welding distributor for prompt delivery of the best in welding electrodes, holders, seam welding wheels, forgings and supplies.

In Canada, made and sold by Johnson Matthey & Mallory, Ltd., 110 Industry Street, Toronto 15, Ontario.

For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio.

30 Years of Welding Progress

P R MALLORY & CO Inc.

MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

Towmotor Introduces Pace-Maker Line of Fork-Lift Trucks

Model 540 fork-lift truck is one of five trucks offered in Pace-Maker series. Truck is built to handle bulky materials and loads weighing up to 3½ tons. Other models have lifting capacities ranging from 6000 to 11,000 lb.

Choice of standard transmission or company's TowmoTorque drive is available, and power steering is optional equipment on all models. Functional body design is said to provide greater driving comfort and easy accessibility to engine and parts. Adjustable off-center seating provides maximum visibility.

Engines are available in gasoline, diesel, or L-P gas-powered types. Engines are reported to have greater power than those in previous models.

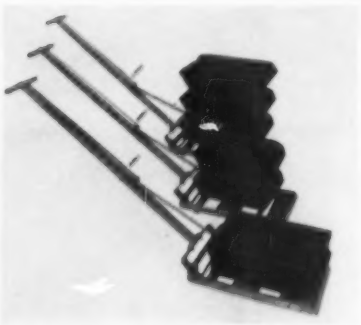
Towmotor Corp, 1226 E 152nd St, Cleveland 10, Ohio

Fork-Lift Truck Designed For Loading Dock Work

An addition to Automatic's line of dockers ranging from 1000- to 4000-lb-capacity trucks, 3000-lb 48-in. model can operate in 7½-ft aisles and can lift a capacity load 128 in. Docker is 96⅜ in. long and 38 in. wide, has total weight (with battery) of 5900 lb.

Battery compartment top is hinged, sides are removable, and steering wheel is hinged for overhead or side battery removal. Travel speed at 24v, depending on load, is 4½ to 5 mph; lift speed is 30 to 55 fpm. Forks are adjustable from 7 to 32 in., and mast assembly tilts 10° backward or 3° forward. Docker is available with either monolift or duolift hydraulic lift.

Automatic Transportation Co, 149 W 87th St, Chicago 20, Ill



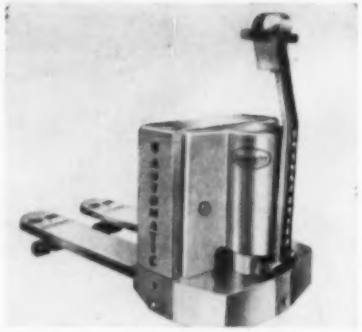
TOTE BOX ROLLER-TOTER called "George" Model GR is offered in improved version which incorporates refinements in chassis design and placement of rollers. Hand-operated mover reportedly can be used with all standard types and sizes of tote boxes—*Rolock, Inc, 1350 Kings Hwy, Fairfield, Conn*

Medium-Duty Platform Trucks Have Light Weight, Narrow Width

Narrow width of this all-steel line permits easy passage through doorways, aisles, and congested production areas.

Four models, with solid rubber wheels, are available for varying load and application requirements. Deck sizes are 18x32, 24x48, and 24x36 in. Load capacities are from 500 to 750 lb. Units can be furnished with one or two handles.

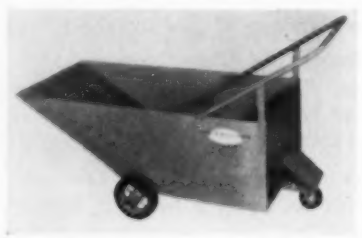
Milwaukee Truck Co, 250 N 12th St, Milwaukee 3, Wis



PALLET TRUCK, Model WP-4 in Transporter series, has 4000-lb capacity. Another model is available with capacity of 6000 lb. Extremely compact, truck measures only 21½ in. plus length of load, although the battery compartment accommodates 8¼-in. standard batteries — *Automatic Transportation Co, Div of Yale & Towne Mfg Co, 149 W 87th St, Chicago 20, Ill*

Lift truck accessories added to Towmotor line include an overhead guard attachment designed to provide protection by shielding the driver from materials that may fall from unwieldy or high-stacked loads; guard consists of a pipe framework which forms a protective roof over the driver. Another accessory, a carton clamp, is a hydraulically operated device for handling multi-unit loads of cartons, crates, or packages. Clamp arms have rubber-covered faces for added protection to load, and have detachable couplings which offer quick removal of device.

Towmotor Corp, 1226 E 152nd St, Cleveland 10, Ohio



CHIP CART designed for use with machine tools which have low bed clearance is constructed of 12-gage steel. Cart body is mounted on two 8-in. wheels and one 4-in. swivel caster. Either solid steel or rubber-tired wheels are available. All joints are welded. Model 47 cart has an over-all height of 20 in. with a capacity of 7 cu ft. Length is 48 in. and width is 28 in.—*Coolant Equipment Corp, Verona, Wis*

R B&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

What's the right torque for bolts?

This is one of the toughest questions we're asked. Too many variable conditions. But the following may help.

The bolt takes two stresses during wrenching: (1) Torsion, (2) Tension. Tension is what you want. Torsion is the necessary evil due to friction. Probably 90% of applied torque goes to overcome friction.

With the friction factor changed by lubrication, plating, etc., the torque needed to produce a given tension is hard to predict. However, a useful empirical formula exists for *normal* friction conditions.

Inch-lbs. Torque = 0.2 x bolt diameter x bolt tension

Many tests show that the 0.2 torque coefficient is approximately constant for the usual friction conditions, for all diameters, and for both coarse and fine thread. Average deviation is about 7%. But when are conditions *"normal"?* The only *sure* way to check torque is to set up a pilot assembly and try it out.

In pilot testing for rigid joints, tighten a few bolts with torque wrench to failure, and then set torque at 75% of that load; or even at yield strength, since torsion component vanishes leaving bolt under tension only, which is well below ultimate strength.

We've worked up curves giving suggested torques for various size bolts. Send for a copy.

How to make a stronger joint

From research on structural steel joined with high strength bolts come facts applicable to *products:*

These bolts can be torqued to high tension for a large clamping force on joined members. Resultant friction overcomes shearing forces and prevents slippage. The higher compressive forces also protect bolt holes from fatigue cracks. Moreover, the tighter the bolt, the less chance for loosening, and the less risk of bolt fatigue due to dynamic loading.

High strength bolts are stronger in shear, too. In recent tests, rivets and "soft" bolts broke under extreme shear load; but high strength bolts didn't – the joined steel failed first.

APPLYING THE ADVANTAGES

Since high strength bolts have 2 to 3 times more tightening strength than common bolts, smaller diameter bolts can be used. As discussed above, these make a stronger joint; also weigh and cost less.

Along with good joint design, it's important that fasteners used can meet requirements. For example: A manufacturer designed vibrating machinery for high tensile bolts, but it was assembled with low carbon bolts. Joints failed. RB&W high carbon bolts with hardened washers solved the problem.

Moral: *Specify* even your standard fasteners.

RB&W selects the proper grade of steel to give "Empire" high strength fasteners the precise balance between *tensile strength* and *ductility.*

Feel free to call on RB&W for help in selection and use of standard, low cost fasteners.

Three radial dashes on bolt head denote a high strength bolt. The "E" identifies Empire bolts, an RB&W trademark. These markings assure highest quality standard fasteners with full strength, and uniformity of size and physicals.

●

Russell, Burdsall & Ward Bolt and Nut Company . . . plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

Silicon bronze fasteners combine desirable features

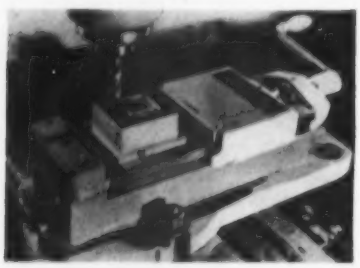
Silicon bronze offers the highest conductivity of fasteners able to withstand high stresses. It resists corrosion, stays free from season cracking, too. It makes ideal fasteners for electrical use where tensile strength is important; or for corrosive environments.

One of the first to develop such fasteners, RB&W cold works them for tensile strength and for clean, well formed threads that don't seize. Oval bolts, hex bolts and nuts and U bolts available. Specials can be developed.

Fork Truck Clamp Attachment

Clamp attachment for fork-lift truck is designed for the transportation and dumping of open-bottom bins or boxes. Rotating attachment has a single arm which through hydraulic pressure holds the bin or box securely against truck forks on which attachment is mounted. Any type of container equipped with runners, in a height range of from 15½ to 35 in., can be picked up on forks, gripped with upper arm, and dumped by rotating motion of the attachment. On a 4000-lb-capacity lift truck, attachment can handle a load of 3000 lb.

Yale Materials Handling Div, Yale & Towne Mfg Co, 11,000 Roosevelt Blvd, Philadelphia 15, Penna



IMP Hold-Down Vise Minimizes Setup Time

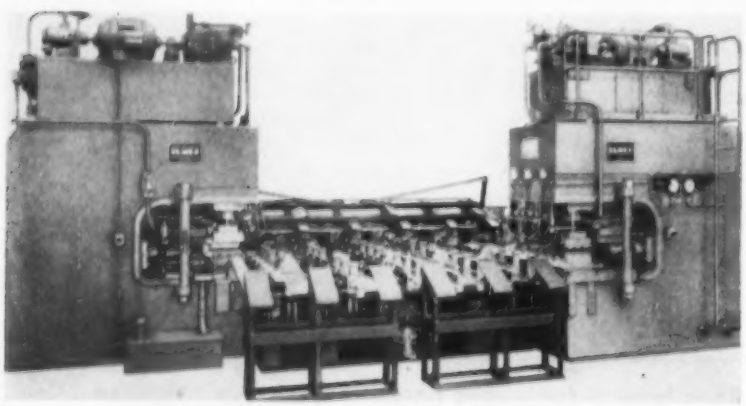
Machine vise that pulls the work downward when closed so that seating is accurate eliminates need for hammering or parallels. Piece can be positioned and clamped with one hand.

Unit has two hinged automatic pull-down jaws. In open position heel of each jaw rests on four spring-loaded buttons which hold the clamping surface of the jaws 1/32 in. above clamped position. As vise is tightened, these jaws continue to hold downward movement against the buttons until heels of jaws make contact with the counter. Vise clamps both laterally and downwardly at the same time. Manufacturer states that because of holding accuracy close tolerances can be held on interrupted cuts. Device has a 4-in. capacity with optional stretching block that will increase capacity to 6 in. Width of jaws is 5 in.

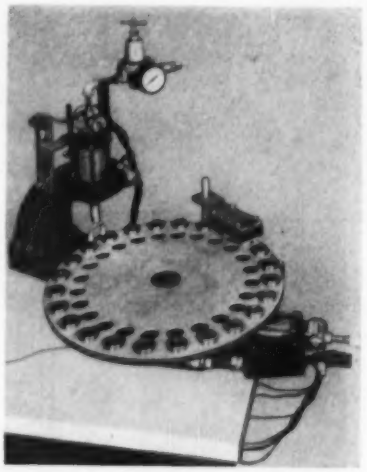
Illinois Metal Products, 429 W Superior St, Chicago 10, Ill

Hand-hoist line called Load King has been extended to include capacities of 3, 4, 5, 6, 8, 10, and 12 tons. Maker reports that design makes possible less working parts and less weight, as well as reduction in headroom. Hoists have reported efficiency of 95% through the use of precision parts and utilization of ball bearings on all rotating shafts. Other features: load brake, one-piece housing, and drop-forged safety hook.

Yale Materials Handling Div, Yale & Towne Mfg Co, 11,000 Roosevelt Blvd, Philadelphia 15, Penna



TUBE-REDUCING PRESS developed by Elmes is fully automatic in operation. Press removes a piece of tubing stock from a loaded magazine, positions piece prior to its entering the machine, carries it into a 3-stage work station where reducing operations are performed, and then removes finished tube and deposits it in a tote box. Unit is equipped with two C-frame stationary ends, each having three 25-ton tube-clamp rams and three 10-ton reducing rams, and is designed to reduce the two ends of 2-in.-dia by 0.062-in.-wall steel tube from 2 in. to 1¼ in., at rate of one every 12 sec. Tubes of length from 54 in. to 13½ ft are handled automatically without any adjustment being made to the press for handling the different-length tubes—*Elmes Engineering Div, American Steel Foundries, 1150-A Tennessee Ave, Cincinnati 29, Ohio*

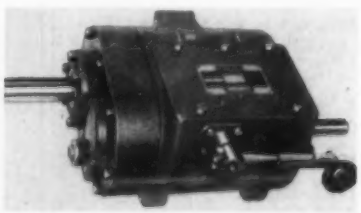


Electromark Machine Provides Automatic Marking on Metal

Model JB-500, designed for the automatic electro-chemical marking on metal of trade-marks, parts numbers, and other identification marks, is reported to produce up to 3600 pieces per hour. Index-type machine is operated by air and controlled electrically. It can be hand fed, stack fed, or hopper fed, depending upon part and speed requirements.

Electro-chemical marking makes a permanent mark without distortion or displacement of metals, does not deform work or leave burrs. Because no pressure is required, process does not set up a stress or strain the metal part.

Electromark Corp, 2093 E 19th St, Cleveland 15, Ohio

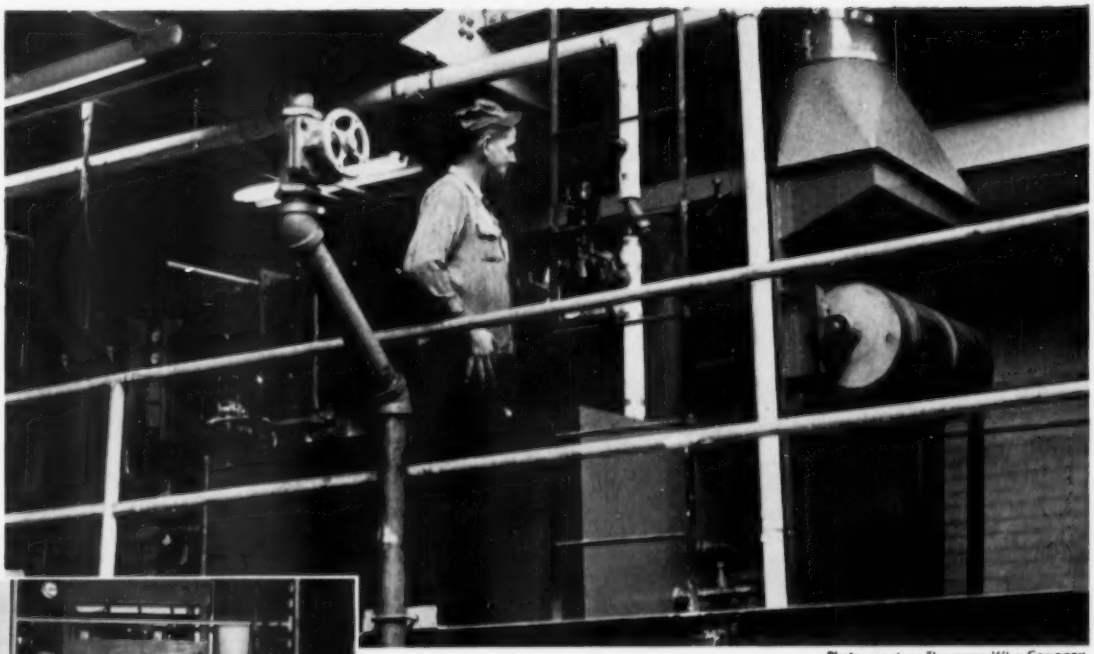


Forward & Reverse Transmission Equipped With Clutch Control

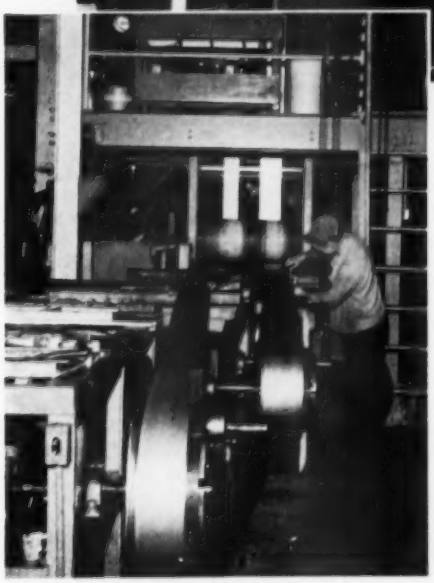
Maximum reduction of Model 17100 is up to 3:1; torque capacity is 865 lb in.

Gears and shafts are of alloy steel, heat-treated, and gear teeth are shaved. Revolving shafts operate on anti-friction bearings, and case is provided to hold lubricant. Forward and reverse shift is controlled by lever. Weight is approximately 120 lb.

Western Manufacturing Co, 3400 Scotten Ave, Detroit 10, Mich.



Photos courtesy Thompson Wire Company



Above (right)—In this continuous installation, strip steel is treated with Bonderite, then with Bonderlube lubricant. *Below*, treated strip is re-coiled as it comes out of the machine, Bonderite-Bonderlube treated.

Successive steps in forming a small case from Bonderite and Bonderlube treated strip.

For better performance in the forming dies . . .

Get steel strip, mill-treated with

BONDERITE *and* BONDERLUBE

Here's a service that can mean real savings in your cold forming operations. Buy mill-treated steel, in coils, treated with Bonderite and Bonderlube and ready for the dies.

This specially treated strip, with its Bonderite-Bonderlube coating, is used for many products and components made by cold forming. The combination of Bonderite and Bonderlube provide such effective lubrication that severe deformations are possible without marring surface finish. Tools and dies last longer, production may be greatly increased, production costs are reduced.

Investigate mill-treated steel strip with Bonderite and Bonderlube. Ask your strip supplier about this new development.

**Bonderite, Bonderlube, Parco, Parco Lubrite, Parker Pre-Namel—Reg. U.S. Pat. Off.*

PARKER RUST PROOF COMPANY

2196 E. MILWAUKEE, DETROIT 11, MICHIGAN

Since 1914 — leader in the field

BONDERITE	BONDERITE and BONDERLUBE	PARCO COMPOUND	PARCO LUBRITE	TROPICAL
corrosion resistant paint base	aids in cold forming of metals	rust resistant	wear resistant for friction surfaces	heavy duty maintenance points since 1883

VIBRATORY POWER UNIT was developed for use with Perry small parts feeders. Unit is designed on a three-spring suspension principle, with springs nearly vertical, to accomplish a gentle flow of parts. Solid base is surrounded by a cover held in place by snap-lock fasteners—*Perry Equipment & Engineering Co, 3100 Brandes St, Erie, Penna*

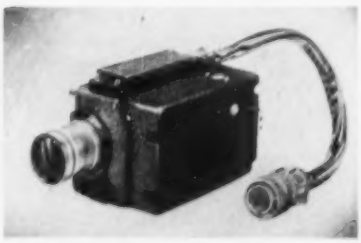
Magnetic-Conveyor Railing

Magnetic railing designated Magna-Rail is designed to convert belt-conveyor lines to permanent, non-electric magnetic conveyors. Available in standard lengths of 3, 4, 5, and 6 ft, railing consists of Alnico-V magnetic castings 4 in. wide and 1 15/16 in. high.

Rails are made in two magnetic strengths. Model MCR-3112 is for conveying average ferrous objects of medium size at speeds up to 85 fpm. Model MCR-316 is for handling, at greater speeds, more difficult materials or unusually shaped objects where contact with belt is small, where non-magnetic and magnetic components are involved, and where tangled masses or objects are encountered.

No outside power is required with rails, and no maintenance is needed. Permanent-magnet element is guaranteed to last indefinitely.

Eriez Mfg Co, Erie 6, Penna



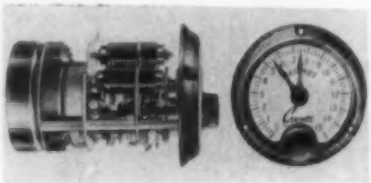
Multi-Synchronous Cameras

Developed primarily for use in military aviation, multi-synchronous camera called SynCamera is being marketed for general industrial use, and offers possibilities for cutting-tool research, operation of machines, and feeding devices on equipment. Small and lightweight, cameras are available in 16mm (illustrated) and 35mm models.

Devices photograph motions or events taking place simultaneously at separated locations. Synchronous control system, self-contained within each camera, eliminates need for any mechanical connections from camera to camera. Shutter and film drives are synchronized to an accuracy of 1½ milliseconds from camera to camera, providing automatic and immediate frame-for-frame comparisons of films taken by any number of cameras in a parallel-operated gang. Three individual coding lights in each camera permit the coding of film sequences and indicate time intervals on the film.

Cameras can be purchased for less than $4000 each.

Flight Research, Inc, Richmond, Va

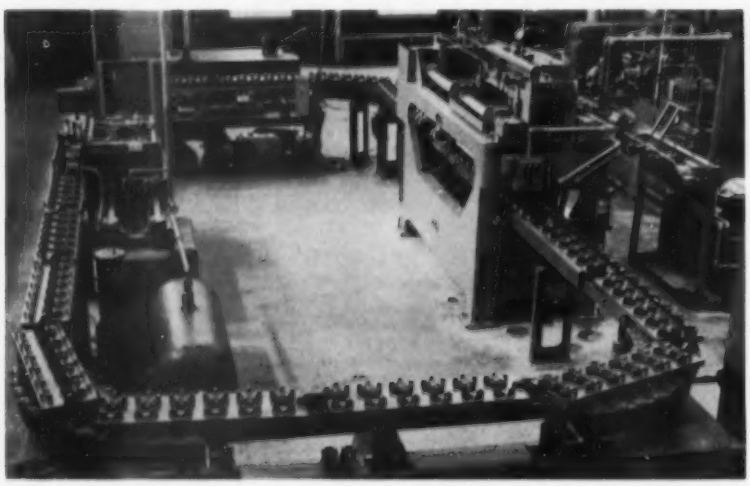


Time Delay Relays

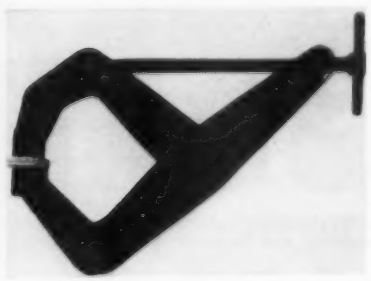
Type 412 and Type 422 are reportedly capable of maintaining repeat accuracy within ±¼ of 1% of full scale (30 sec and longer ranges), ±½ of 1% on faster ranges, approximately twice the accuracy of previous models.

Silver cadmium contacts rated at 15 amp have quick-make, quick-break wiping action and are of much larger size than previously used; nine-position terminal block permits easier wiring from side or back with wider range of circuit possibilities; friction setting mechanism allows adjustment even while timer is operating.

R W Cramer Co, Centerbrook, Conn



BEARING CAPS are bolted in place on automotive-engine connecting rods by special automatic assembly system which has a capacity of 2000 connecting rods per hr. Bolt-press unit is electro-hydraulically powered, nut-setting unit is electro-pneumatically powered. System is fully automatic after connecting rods enter on fixtures on a continuously moving conveyor, ready for bolts to be pressed in and nuts set. Operations are performed while rods are traveling at speed of approximately 22.8 fpm—*Cleco Air Tools, Div of Reed Roller Bit Co, Houston, Tex*



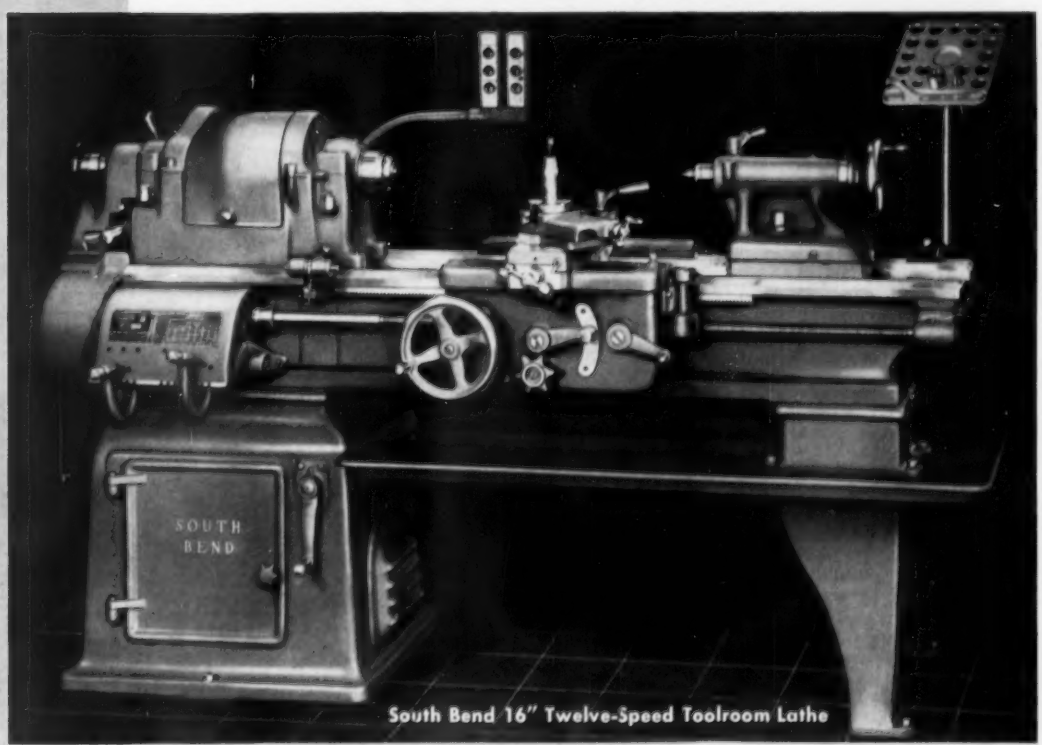
KANT-TWIST CLAMP, heavy-duty 9-in size, has jaws grooved on one face and serrated on opposite face. Trunnions and jaws are core hardened; side plates are high-tensile steel—*Saxton Manufacturing Co, 1517 N Potrero, El Monte, Calif*

Cuts Machining Time

The wide range of spindle speeds on this new lathe cuts machining time because the operator quickly selects the right speed for each operation. Pushbutton control provides a fast change from any high speed to the corresponding low speed. This versatility is further increased by 48 choices of longitudinal and cross feeds which insure maximum efficiency on every job. Also, you will find that its accuracy and ease of operation makes your tough job easy. Send the coupon for complete information.

SOUTH BEND 12 SPEED LATHE

CL8155C. 6' bed, below. F.O.B. factory less electrical equipment. Low down payment. Only 3¼% annual interest on original unpaid balance. **$2806.00**



South Bend 16" Twelve-Speed Toolroom Lathe

Hardened and ground bed ways in lieu of regular at small extra cost.

SPECIFICATIONS

Spindle Speeds — 12. Direct drive: high range 300, 550, 945; low range 150, 278, 475. Back gear drive: high range 32, 70, 118; low range 20, 33, 60.

Spindle Bore — 1⅜".

Swing over bed and saddle wings — 16¼".

Swing over saddle cross slide — 9⅛".

Distance between centers — 33¼", 45¼", 57¼", 81¼", 105¼".

Collet Capacity — 1" maximum.

Longitudinal Feeds — 48 R.H. or L.H., .0015" to .0841".

Cross Feeds — 48, .0006" to .0315".

Thread Pitches — 48, 4 to 224 per inch.

SOUTH BEND 1900 50th ANNIVERSARY 1956

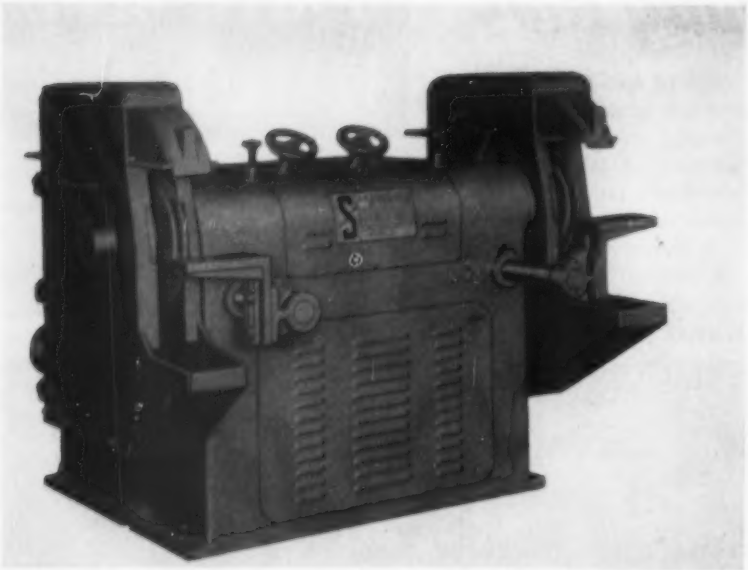
PLEASE SEND INFORMATION CHECKED:

☐ 9" and 10" BENCH LATHES ☐ 10" to 16-24" FLOOR LATHES ☐ DRILL PRESSES ☐ ½" & 1" Collet TURRET LATHES ☐ TOOL GRINDERS ☐ 7" BENCH SHAPERS ☐ MILLING MACHINES

Name_____ Street_____

City_____ State_____

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana



Variable-Speed Snagging Grinders

Twin-motor double-end grinder is a 2-in-1 machine on which each side is independent. Each wheel operates at its own correct speed, irrespective of wheel diameter; one wheel may be stationary while other wheel is operating. Model is available in three sizes: two 7½-hp or two 10-hp motors for 24-in.-dia wheels, and two 10-hp motors for 30-in.-dia wheels.

Also available is a single-wheel model, with wheel on either right or left side. Sizes offered are 20-in. wheel with 5- or 7½-hp motor, and 24- or 30-in. wheel with 7½, 10, 15, 20, 25, 30, 40 or 50-hp motor.

Both machines have plate-steel, double-protection wheel guards with stress-relieved welds. Safety interlock maintains exactly 9000 sfpm throughout wheel life, so that wheel has the same cutting action when worn as when first mounted. No tools or wrenches are required to accomplish a speed change, which may be made while grinder is running.

No tools are needed for access to the grinding wheel. A positive shaft lock is provided for use when wheels are being changed.

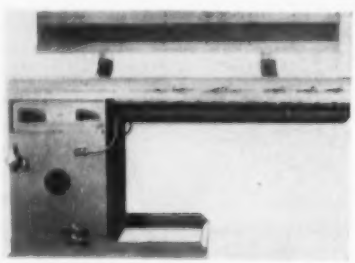
Foundry Grinder Div, Standard Electrical Tool Co, 2480 W 6th St, Cincinnati 4, Ohio

Ceramic Cutting-Tool Material

Seramet is designation for Vascoloy-Ramet ceramic cutting-tool material available in triangular and square throw-away inserts for negative-rake toolholders. Material of aluminum-oxide base is designed especially for light-to-moderate cuts at high speeds on steel, cast iron, and non-metallics. According to maker, great hardness and crater resistance of Seramet make it practical for use at speeds of 1000 to 2000 sfpm.

Suggested starting condition is a depth of cut up to ⅛ in. with a feed from 0.005 to 0.018 ipm, subject to variation depending upon operation and material being cut. Negative front rakes and negative side rakes of from 5 to 7° are recommended. Bulletin 56-2.

Vascolet-Ramet Corp, Waukegan, Ill



Longitudinal Seam Welder Is Double-Acting Model

Series G is designed for use with either inert gas or submerged arc welding heads which can be purchased with machine if desired. Unit, engineered primarily for light gage welding of stainless and aluminum alloys, has also been used successfully for welding mild steel and steel alloys up to 10 gage in thickness.

Lower horn, circular in shape to permit welding of small diameter work, is equipped with a copper or other non-ferrous back-up bar which serves to back up the longitudinal seam as it is being welded. Double-acting upper horn permits independent clamping of either side by means of foot-operated air valves. Clamping arms are made of automotive spring steel with special arched design which assists in forcing the edges of seam together.

Six standard models are available in capacities from 24 in. x 10 ga up to 84 in. x 14 ga.

Reed Equipment Div, Webb Corp, Webb City, Mo

Multiple-Purpose Bench Comparator

Jerpbak-Bayless comparator is designed for heavy-duty use to measure parts in various sizes and shapes. Device checks pitch diameter on splines and gears (externally or internally), length, shoulder distance, center to center, and OD and ID dimensions, as well as many others. Range capacity is from 0 to 6 in.

Parts in their entirety, or any portion, are inspected by holding the inspection area between two adjustable contact points. External or internal measurements thus obtained are readable on a dial. Instrument may be set to operate in a vertical, angular, or horizontal position.

Tooling for bench-model comparator is interchangeable with tooling on company's other comparators. Accessories available include standard anvils, V-blocks, locating fixtures, and master setting gages. Ball, cone, flat, or special-form points are offered.

Jerpbak-Bayless Co, Solon, Ohio

Sperry

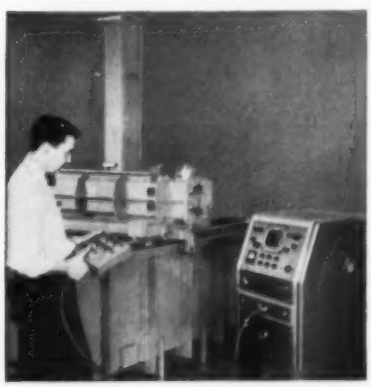
ultrasonic inspection news

SIMAC INSPECTION SYSTEMS NOW AVAILABLE FOR GENERAL INDUSTRY USE

Through the development of standard-unit ultrasonic inspection equipment and auxiliary components, Sperry makes it possible to assemble automatic or semi-automatic SIMAC systems at greatly reduced costs. The basic unit is the Type UW Reflectoscope which can be combined with auxiliary test equipment to meet individual flaw detection requirements. Shown above, the UW Reflectoscope is being used to inspect an immersed aircraft forging which has contours requiring the use of a precision (PH) search unit positioner in order to control the direction of the ultrasonic beam projected into the part.

For contact or immersion testing:

The flexibility of the UW Reflectoscope enables it to handle a vast range of inspection problems, both contact and immersed. It is designed to be operated manually, semi-automatically (as shown at the left) and fully automatically in conjunction with other Sperry-engineered equipment.



The UW's wide range of 9 operating frequencies (from 200 kc to 25 mc) permits driving through coarse material or long distances using the lower frequencies, while the high frequency range can locate the smallest defects.

Immersion tanks have been standardized in several sizes to meet different inspection requirements and are also built to specification.

Automatic Signaling and Recording

The UWA Monitor is designed to operate in conjunction with the UW Reflectoscope to provide automatic signaling and recording of defects. Set up for a specific test, it interprets signals from the UW Reflectoscope and passes on the evaluated information to the operator in the form of signal lights and alarms. Permanent tape records can be made as well as actual automatic marking of the part under test.

Two additional displays of test information:

The UWB attachment supplements the Monitor with a cross-section view of the material being tested, displayed on a 12-inch CRT screen with long image persistence. Two meter indicators measure the amplitude of reflected signals.

To keep posted on latest developments in the profitable use of ultrasonic inspection, send for your copy of our Ultrasonic Inspection News Letter.

AM-5

Sperry Products, Inc.
602 Shelter Rock Road
Danbury, Connecticut

☐ Send me detailed Reflectoscope information.

☐ Send me the Ultrasonic News Letter.

Name _____

Title _____

Company _____

Address _____

City _____ *Zone* _____ *State* _____

sperry products INC.

FIRST IN ULTRASONIC INSPECTION

For complete information plus list of sales offices, see our catalog in your company's copy of Sweet's 1956 Plant Engineering File.

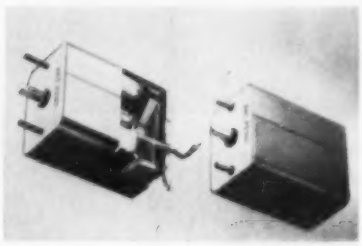
Small-Parts Hopper Feed

High-speed hopper and counter designed for production feeding of small parts is known as Feed-A-Matic. Delivery speeds of up to 200,000 units per hour are reported possible, depending on size and shape of work. Changeover from one type of part to accommodate another is said to take about 5 min in the plant.

Unit consists of a cast-iron or aluminum barrel with cast-in pockets. Parts being fed are captured in these pockets as the barrel revolves and are trapped by a stationary plate as they are carried to top of the hopper. At this point the plate ends, allowing parts to flow down a chute, where they are orientated and fed to the final point of delivery. Parts not properly oriented are rejected back into the hopper by a revolving wheel.

Either mechanical or electrical control of release fingers gives individual or predetermined accurate count.

U S Engineering Co, 40-24 22nd St, Long Island City 1, NY



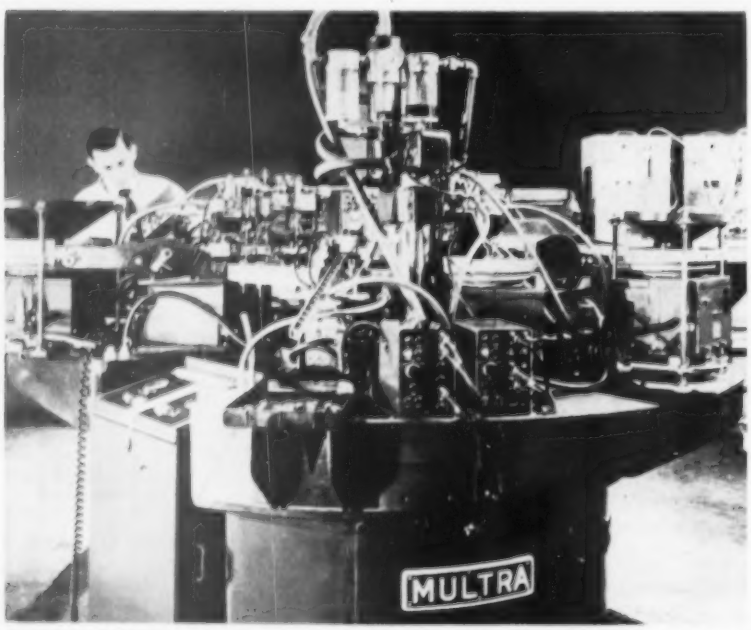
Rectangular-Shaped Motors

Leece-Neville rectangular-shaped motors, designed to give the same output as comparable round motors but in significantly less space, are available in ranges of 6, 12, 24, and 32v with outputs up to 140 oz-in. Possible use includes any application where space is limited.

Rectangular construction of motor is made possible by a design in which the flux path is axial with the armature shaft, as opposed to conventional motors whose flux path is concentric with the shaft. Special flux path is made possible by a special pole-piece pattern.

Motors feature all-welded construction with 3/16-in.-thick stampings. Broad, flat surfaces permit attachment of assembly bolts in any position. Shaft can be extended from both ends for double-load application. Motors can be made waterproof, and sintered bronze bearings at each end of the shaft eliminate need for oil wick reservoirs.

Leece-Neville Co, 1374 E 51st St, Cleveland 3, Ohio



MERCURY BATTERIES are turned out at the rate of 15,000 to 20,000 per 8-hr shift on multi-purpose automatic assembly machine called Multra, which performs all the assembly operations that normally require an operator. Machine feeds, sorts, sizes, forms, orients, and inspects five different battery parts: metal cylinder and caps, felt absorbent, neoprene grommets, pressed metal, and liquid electrolyte. Parts are fed from work nests located around machine at work stations. Machine can be indexed with accuracy of ±0.002 in. Sixteen tooling stations can be assembled around the 6-ft-dia table—*Multra Corp, Div of Barnes Engineering Co, Stamford, Conn*

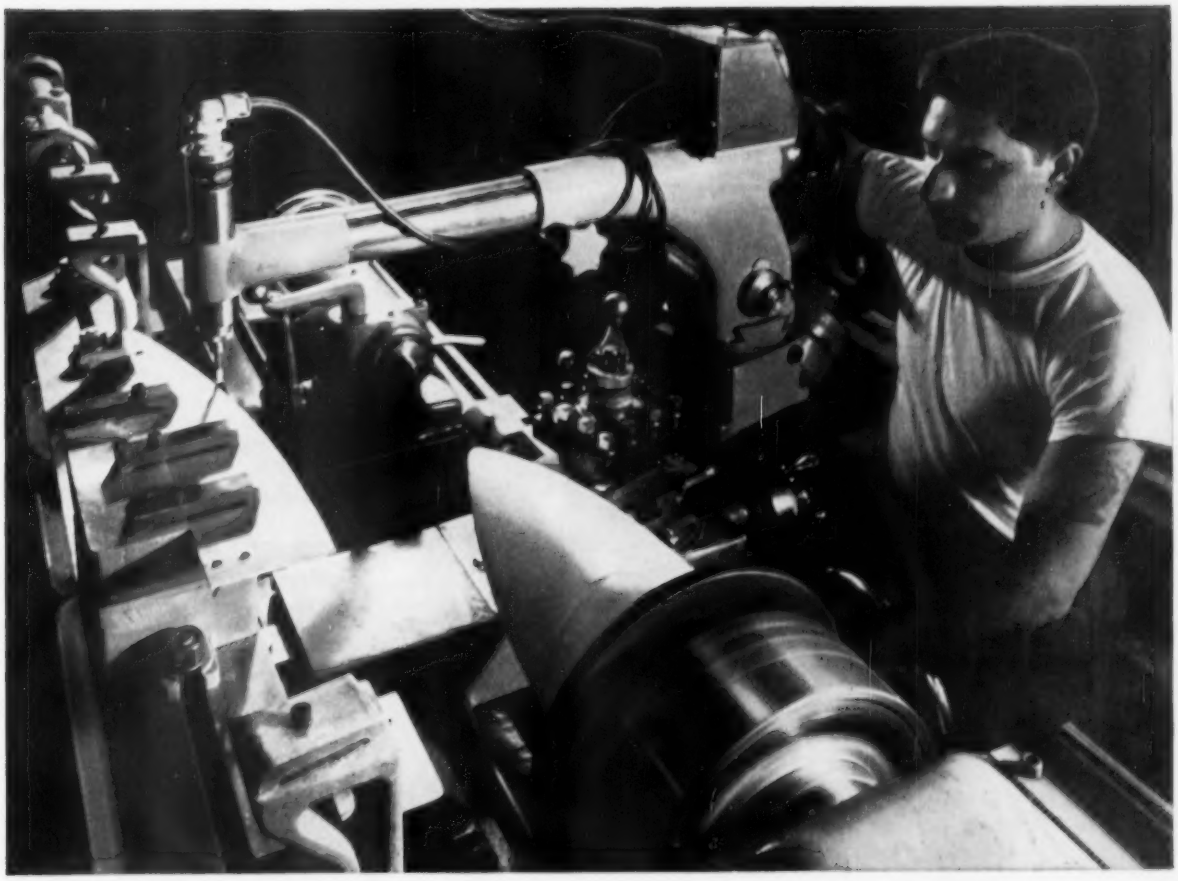
Hydraulic Milling Machine

Romulus 3-D Hydro-Cycle miller features an all-hydraulic spindle with infinite speed selection. Machine will mill left or right, forward or back, and up or down, and reportedly will cut circles to within 0.002-in. tolerance.

Vertical, cross, and longitudinal movements are synchronized and controlled through a pencil-type stylus arm. All movements are manually controlled by guiding the stylus arm over the surface of the part which is to be duplicated.

Hydraulic spindle has a speed range of from 200 to 2500 rpm. Standard heads are available up to 50 hp, and can be built to special order over 50 hp.

Romulus Tool & Engineering, 13581 Huron River Dr, Romulus, Mich



How Electronic Duplication Reduces Your Precision Machining Costs

INCREASES PRODUCTION

You cut machining time by 50% or more with Raytheon's automatic precision duplicator. Human error is minimized and the need for gaging is eliminated. You save considerably on labor costs since the machine may be run by a relatively unskilled operator.

CONTOUR ACCURACY

You obtain uniform reproduction from flat templates or models for contouring, profile facing and boring to a tolerance of ±.0015" between template or model and work piece. Another important advantage is that this electronic duplicator as attached to machine tool in no way interferes with conventional operation when used for non-contouring purposes.

TROUBLE-FREE

Problems of leakage, temperature change and valve wear normally associated with duplicators are non existent in the electronic duplicator and maintenance requirements for Raytheon electronic duplicators are exceptionally low. These units have been in the field since 1949 and have an enviable service record.

WIDE RANGE OF APPLICATION

Your lathes, horizontal and vertical boring mills, millers and grinders may be used with Raytheon electronic duplicators. These duplicators are available in single motion—contour to 90°; dual motion—180°; two motion—360°.

For full information write Dept. 6120, Raytheon Manufacturing Company, Waltham 54, Mass., or contact Voss Engineering Company, 7301 Penn Ave., Pittsburgh 8, Pa.

RAYTHEON MANUFACTURING COMPANY

Equipment Marketing Department, Waltham 54, Mass.

RAYTHEON

Excellence in Electronics

THIS MINSTER No. 4 PRESS IS INSTALLED WITH ONE

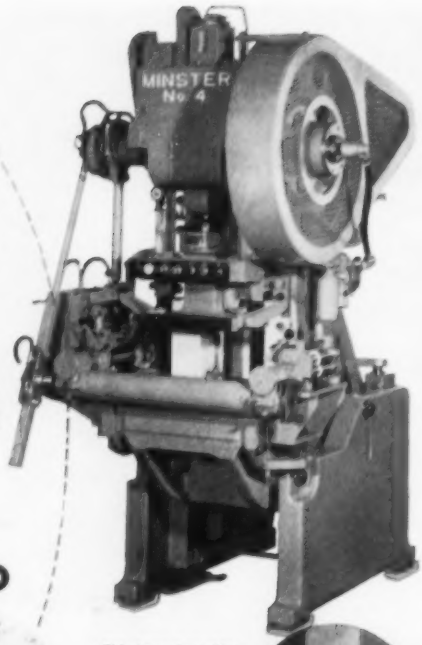
VINYL

Air-Loc

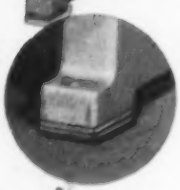
"PACKAGED FLAT"

ONLY $12.95

POSTPAID IN U.S.A.



This impact machine installed on 8 mounts 4½" x 4½" to provide double thickness under each foot.



Air-Loc

THE VINYL MOUNT that dampens vibration, gives you these advantages . . .

1. VINYL CONSTRUCTION is impervious to oil, water, alkali and weak acids. 2. EASY TO CUT with a power saw. 3. PERMANENT MACHINE ALIGNMENT. 4. PRECISION SHIMMING is easy. 5. REUSABLE when relocating machines. 6. NO "WALKING", anchored by friction without bolts or cement. 7. REDUCES VIBRATION up to 85% due to patented construction.

Use one "Packaged Flat" to prove this in your own plant.

ONLY $12.95

POSTPAID IN U.S.A.

Each package contains one 9" x 18" sheet of **Air-Loc** 4-17-4, one sheet of **Air-Loc** shim holding material and instructions for easy installation of 1 to 3 machines. Each mount ¼" thick is made up of one piece of each type of **Air-Loc**.

AIR-LOC DIVISION

Clark, Cutler, McDermott Co., Franklin, Mass.

NAME _____ (Please print)

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE ____ STATE ____

☐ Please send one "Packaged Flat" @ $12.95 postpaid, U.S.A.

☐ Please send samples and booklet about Air-Loc.

Sciaky Force Gage Measures Electrode Pressure Changes

Designed to make dynamic measurements on a recording oscillograph of the force changes between the electrodes of resistance-welding machines, strain-gage-type unit is mounted on a cantilever beam of non-magnetic materials. One end attaches to the horn of the lower arm and the other end mounts on the front of the machine base-plate. Force is transmitted to the assembly by the motion or deflection of the lower arm with respect to the base-plate.

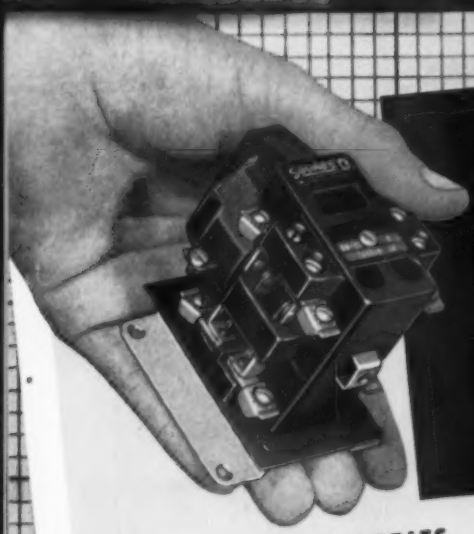
Cantilever beam can be adjusted to accommodate machines with throat depths from 12 to 60 in. by means of a three-section telescopic tube arrangement. Stops are provided which limit deflection of the cantilever to prevent accidental over-stressing. Unit may be mounted on spot welders or seam welders.

Force gage is completely shielded. Recording oscillograms may be made of both electrode force and secondary current simultaneously. Strain-gage leads are terminated in an octal socket mounted on force-gage assembly. Buyer should specify manufacturer, type, and serial number of machine; throat depth; and diameter of lower horns.

Sciaky Bros, Inc, Dept M-7, 4915 W 67th St, Chicago, Ill

Dacron after-filter bags are now furnished on all new Torit FB cyclone-type dust collectors. Material will not burn when exposed to sparks, will not shrink, is moth- and mildew-proof, according to manufacturer. Bags are also available for machines now in operation.

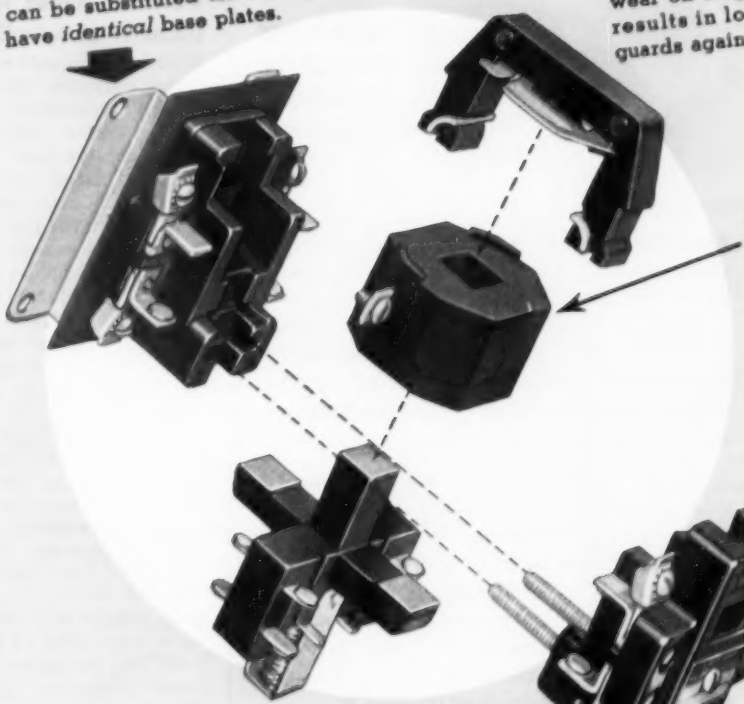
Torit Manufacturing Co, Dept KP, 287 Walnut St, St Paul 2, Minn



this new, small size SQUARE D RELAY has features you'll like!

NO MOUNTING WORRIES
When more contacts are required, the 4-pole relay (DO-42) can be substituted for the 2-pole (DO-22). Both have *identical* base plates.

OUTSTANDING PERFORMANCE
Balanced construction reduces wear on single moving part... results in long life and safeguards against down time.



RESISTS DAMAGE
Plastic impregnated molded coil is unbreakable, operates cooler, is dimensionally stable and impenetrable by water and oil.

20-SECOND DISASSEMBLY
Simply loosen two screws and the entire device is disassembled for normal maintenance.

This new **Class 8501 Type D relay** is amazingly compact. 2-pole version measures only 3⅛" high x 2⅛" wide! 4-pole is only 3 1⅛" high x 2 1⅛" wide! Both rated 10 amperes, 600 volts. Packaged parts kits make normal maintenance easier than ever. Write for Bulletin 8501 which tells the complete story. Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin.

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

SQUARE D COMPANY

MARKING TOOLS AND MACHINERY

LEAVE STERLING IMPRESSIONS ON FINE SILVERWARE!

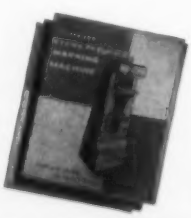
MARK INTRICATE SPOON CONTOURS WITH UNIFORMITY AND PRECISION!

Production stamping of silverware is an exacting operation. Every reject is costly! Thousands of units must be marked clearly—identically—with the last impression as legible as the first. Most blue chip companies know the importance of a quality name on a quality product; that's why they specify marking machinery and tooling by Parker.

A Parker #700 Marking Machine, tooled with a standard Parker #100 insert roll die holder and interchangeable segment type, met every requirement of precision and performance. The "cushioning" effect of the machine table, plus proper set-up, compensated for the curvature of the spoon, assuring clear, uniform production marking throughout runs in the hundreds of thousands.

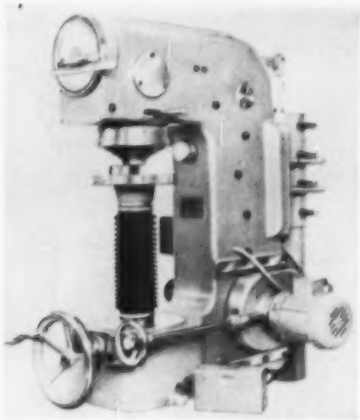
MARKING PROBLEMS?

Send today for literature on Parker Marking Machines, standard and special marking tools.



THE PARKER STAMP WORKS, INC.
MARKING DIE & MACHINERY DIV.
FRANKLIN AVENUE • HARTFORD, CONNECTICUT

by Parker



Motorized Reflex Machine Shows Diameter of Brinell Impressions

Motorized machine which automatically indicates the diameter of Brinell impressions is made to operate on 220v, 3-phase. In production, operator uses machine like a go/no-go gage, and needs only a single glance to tell whether the diameter of the ball impression lies between pre-set limits.

Loads are applied by dead weight, through a motor drive, with cycles adjustable from 5 to 60 sec. Built-in Carl Zeiss optical system automatically projects a magnified image of the indentation on a ground-glass screen.

Various test loads are available, from 120 kg (for Vickers tests) to 3000 kg. Vertical clearance is 16 in., horizontal reach 8 in., and net weight about 900 lb.

Gries Industries, Inc, Testing Machines Div, New Rochelle 2, NY

Gear reducer with infinitely variable speed is provided by building a gearhead into the output side of a fractional-horsepower Zero-Max variable-speed transmission, which has a range from 0 to ¼ input speed. Because gearhead input shaft is integral with Zero-Max output shaft, speed of gearhead output shaft is infinitely variable. Gear reductions of 2, 3, 4, and 5 to 1 that develop 20 to 100 in.-lb of torque are available. Input and output shafts are parallel and output shaft rotates counter-clockwise on standard models. Clockwise operation is also available. Twenty-six models and types with various torque ratings and a variety of ranges of stepless speeds away from zero are available. Unit runs in oil and may be mounted in any position.

Revco, Inc, 1900 Lyndale Ave S, Minneapolis, Minn

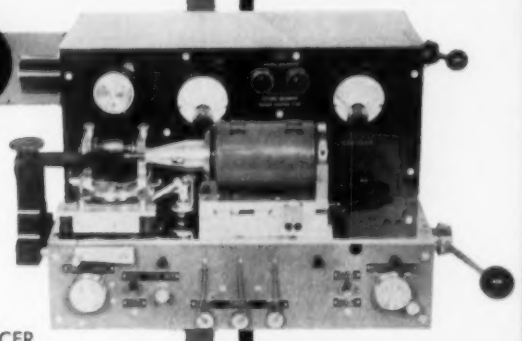
Locates
Measures
Corrects

Detailed information is in Instrument Data Sheet 211, available upon request to Technical Literature Section.

DYNAMIC UNBALANCE

of high speed rotors to better than .00001 inch-ounce

decker **DYNAMIC BALANCER**



without removing the rotor from the mount

The DECKER DYNAMIC BALANCER offers, on a single portable chassis, the complete requirements for precision dynamic balancing. The necessary equipment for rotor mounting, measurement and location of unbalance, plus a precise metered automatic drill for unbalance correction, are included.

Designed specifically for high speed rotors where maximum possible precision of balance is required, the Model 211 Dynamic Balancer is capable of handling any rotor which may be electrically driven at 10,500 rpm or higher.

The many features of the Decker Dynamic Balancer permit rapid instruction of unskilled personnel in its use. Among these features are automatic location and marking of the point of unbalance with precise visual indication of the degree of unbalance.

- **Maintains laboratory type precision balance on a production basis**
- **Does not require a skilled technician**
- **Automatic marking of point of unbalance**
- **Drilling performed without removing rotor.**
- **Precise indication of degree of unbalance**
- **Automatic speed control**
- **Rapid run up to proper speed**
- **Completely self contained and portable (11" x 15" x 21")**
- **Rapid work change over**

decker AVIATION CORPORATION

1361 Frankford Ave., Philadelphia 25, Pa., PHONE GArfield 5-2300

How to Save on STAMPINGS

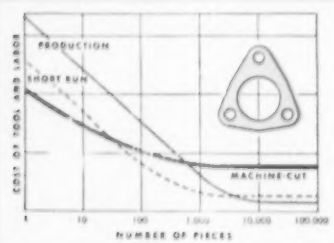
A COST-SAVING, VERSATILE APPROACH TO THEIR MANUFACTURE

Possibly you've always thought that a quick look at the quantity involved decides how a stamping shall be made. Sometimes it is done that way but it isn't the sure way to lowest costs.

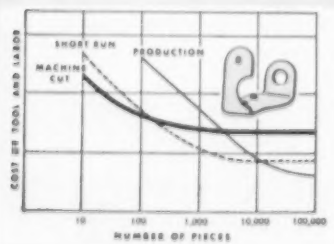
A more scientific approach by the STAMPINGS DIVISION of the Laminated Shim Company in Glenbrook, Connecticut frowns on the term "short run stamping." There is what is known as the short run *method* but there is no definite dividing point between short run and production quantities. Contour, tolerances, material, many other items all affect the manufacturing method when costs are being carefully figured.

NO ONE METHOD IS ALWAYS CHEAPEST; THREE ARE NEEDED

Machine-Cut Method: The STAMPINGS DIVISION goes one step further than Short Run and Production Methods. The Machine-Cut Method, though not strictly a stamping operation is a valuable addition to stamping procedure. Custom built slitters, cutters, saws and files use experience-gained techniques to fashion the smaller quantities of parts. No dies are made; only stock punches are used. Obviously labor cost is understandably high but there is no tool charge.



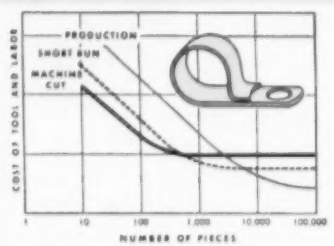
Short Run Method: As quantities increase (and depending upon the complications of contour, material, etc.) the economy of a temporary blanking die must be considered to eliminate the labor expense of machine-cutting. When this point is reached, manufacture is by the Short Run Method and the blanking is supplemented by other bench press operations. Here labor cost is at a medium level but a modest tool charge is incurred.



Production Method: As quantities increase the Production Method using standard dies with high speed automatic presses becomes more attractive. A relatively high tool charge can then be amortized over a great number of parts. Labor charge is negligible.

The Production Method as developed by the STAMPINGS DIVISION is offering unusual cost saving possibilities because of the new low-cost, full service Hecht-type die developed by the company for certain applications.

It is interesting to note that sometimes a very small quantity of parts would require a standard die because of complications or close tolerances or tough materials involved. Thus occasionally a very small quantity goes into the production classification.



LOWEST COST IS ASSURED WHEN SUPPLIER HAS ALL THREE METHODS

The illustrations show typical stamped parts along with relative costs and breaking points for each of the three manufacturing methods. Unless a supplier can offer all three, his costs cannot always be low. For a given quantity, only *one* method can be most economical.

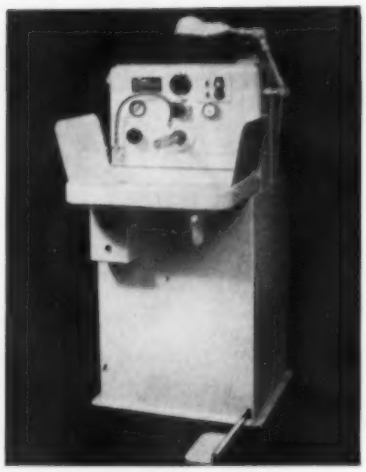
ONE OR ONE MILLION PARTS FROM SAME SUPPLIER

An important corollary to the above is that an experimental part in small quantities can be handled by the same supplier when full production quantities are needed.

Further, it is important that a supplier be fully informed, if possible, on later or total requirements for a given part. As the charts point out, such information will affect manufacturing method and make possible cost reductions.

FURTHER INFORMATION AVAILABLE

An illustrated 12 page brochure describing in greater detail the methods mentioned above is available on request to the STAMPINGS DIVISION
Laminated Shim Company, Inc.
3105 Union Street, Glenbrook, Conn.



Honing Machine Offers Completely Hydraulic System

Model HM Honemaster is manually operated honing machine with a completely hydraulic system which assures constant pressure. Stone pressure control is adjustable to the diameter of the piece being honed, so that stone wear or stock removal causes no fall-off of pressure.

Single-control sizing dial indicator is set by honing the first piece to finish size. Thereafter it is only necessary to compensate for stone wear. Sizing dial indicates when the work is coming to size.

Infinitely variable spindle speeds of from 100 to 900 rpm are provided, together with a tachometer. Clutch and brake mechanism are operated hydraulically. Coolant oil and hydraulic oil are contained in a divided steel tank.

Machine can be operated from foot pedal or from knee pedal. All standard Superior mandrels are adaptable to the machine.

Superior Hone Corp, 1607 Elreno St, Elkhart, Ind

Temperature pellet for 100 F has been developed for such uses as testing effectiveness of insulations, regulating heating and cooling systems, testing prototypes for heat-transfer characteristics, and production-line work where 100 F is prescribed operating temperature. Shipment of low-temperature pellets will be limited to off-summer months; if stored during hot weather, pellets will have to be kept under mild refrigeration. Pellet is addition to Tempil line, which includes 73 regularly spaced temperature ratings up to 2500 F. Samples are available on request.

Tempil Corp, 132 W 22nd St, New York 11, NY

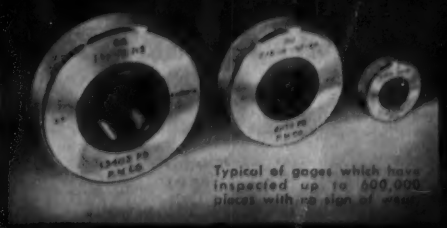
Now!

- TROUBLE-FREE
- ACCURACY
- LONG-LIFE
- FASTER GAGING

with

PMCo Ring Gages

With this proven fixed-type Titanium PMCo Carbide Thread Ring Gage you get all the headlined advantages



Typical of gages which have inspected up to 500,000 pieces with no sign of wear

plus such important benefits as these: use of full product tolerances, no maintenance, assured thread fit after inspection, and ease in handling due to unusually light weight.

Here's why: Pipe Machinery Company's ingenuity and craftsmanship has made it possible to use the round solid design, machine titanium carbide and hold to very close tolerances, achieving standards believed impossible only a decade ago. We know of no other gage that is comparable.

All PMCo Titanium Thread Ring Gages are numbered and registered and the record kept by us for your convenience.

THE PIPE MACHINERY COMPANY
29100 Lakeland Blvd. • Wickliffe, Ohio
Greater Cleveland

● For full details, write for our pamphlet, "Solid Titanium Carbide Thread Ring Gages."

Name _____
Company _____
Title _____
Address _____
City _____ Zone ____ State _____

WIN $2000.00
IN THE WENDT-SONIS TOOL HOLDER "CUT COSTS" CONTEST

New! Different! Interesting! Easy too . . . and you win two ways in the Wendt-Sonis "Cut Costs" Contest. Who's eligible? Anyone employed by a company using the new superior Wendt-Sonis tool holder for throw-away inserts — a proven cost cutter. Keep a record on how you did it — how you "cut costs." Enter the facts on a simple-to-fill-out entry blank — send it to Wendt-Sonis Company for a chance at the prizes. Contest closes June 30, 1956. You win two ways — a chance at the prize — your job done at lower cost with Wendt-Sonis tool holders for throw-away inserts.

briefly — here's all you do . . .

1. Use the coupon below to get your entry blank and clear-cut easy-to-understand contest rules.
2. Be sure you have Wendt-Sonis tool holders for throw-away inserts on your job.
3. Jot down the facts and figures on the job for filling in the standard entry blank. You can base your example on lower tooling costs . . . less downtime . . . more parts per hour . . . *all* of these three . . . or any other savings you accomplished with Wendt-Sonis tool holders for throw-away inserts. Don't worry about neatness, spelling or size and type of job. Enter more than one job if you wish!

Don't be concerned about our using your name or company name in advertising. We wouldn't do that without getting your permission first.

$5000.00 IN PRIZES

1st $2000.00
2nd $1000.00
3rd $ 500.00
4th $ 250.00
and 25 $50 PRIZES
for
DOING YOUR JOB BETTER . . . AT LOWER COST

CONTEST JUDGES

John Grove
Executive Editor
Tool Engineer

Jerome S. Wilford
Executive Editor
Production Magazine

Elmer J. Tangerman
Executive Editor
American Machinist

GET YOUR SIMPLIFIED ENTRY BLANK RUSH!

CLIP — mail now!

"Cut Costs" Contest
Wendt-Sonis Co.
Dept. AM-456, Hannibal, Mo.

I want a chance to win in the Wendt-Sonis Tool Holder "Cut Costs" Contest. Rush me rules and entry blank.

COUNT ME IN!

NAME _____ POSITION _____

FIRM _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Facing Machine Grinds Work Flat and Square

Thiel facing machine, designed to produce flat and square surfaces on any workpiece, has a 14-in. cup-shaped grinding wheel mounted perpendicularly to the table. Parts, which need only one flat surface to be held to the table, are positioned rigidly by squaring and clamping blocks which slide in table keyways. Operating at 1400 rpm, grinding wheel faces cold- or hot-rolled steel, tool steels, steel castings, and all non-ferrous alloys.

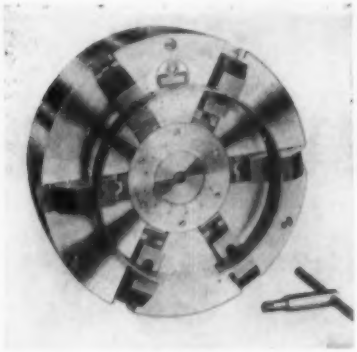
Maker claims great savings in time when machine is used to perform work normally done on a shaper or mill. Uses of machine include preparing stock for layout and sizing die sections and fixture components.

When greater stock removal is required, face mills may be substituted for the grinding wheel. A 6-in.-dia, 12-blade milling cutter is used for ferrous alloys, and will remove up to ¼-in. stock in a single pass. For non-ferrous metals, a 12-in.-dia, 18-blade cutter will make a ⅜-in. cut in one pass. Special gripping fixtures are also available for non-ferrous plate and thin ferrous pieces.

Eastown Tool & Engineering Co, 23672 Schoenherr Rd, East Detroit, Mich

NesTier wire baskets designed for handling fragile or highly finished parts are offered in a number of standard sizes, ranging from 18 x 10 x 3 in. to 24 x 14 x 12 in. To insure proper annealing of welds, baskets are welded on special machines equipped with automatic controls. Standard baskets are furnished in bright-steel wire, but other materials, including stainless steel, are available. Variety of wire sizes, ranging from No. 16 to ½ in., is offered. Either nesting or stacking designs are available, with fixed or movable handles.

Chas Wm Doepke Mfg Co, Inc, 8813 Blue Ash Rd, Rossmoyne, Ohio



Universal Chuck Provides Controlled Centering Pressure

Six-jaw universal chuck with its adjustable centering features operates rapidly to center work without danger of distortion due to overtightening by the operator. Holding pressure desired is set on a calibrated plate in the center of the chuck; universal jaws are then brought into work simultaneously until contact is made and the pre-set pressure is reached. Upon arrival at this point, jaws stop automatically because of a slip-clutch arrangement and hold work at the required pressure until released.

Chucks are manufactured in diameters of 12, 15, 18, 21, and 24 in., suitable for any type of spindle mounting, and are available in 3-, 4-, 6- and 8-jaw styles. Top jaws can be supplied in any style to meet specific requirements.

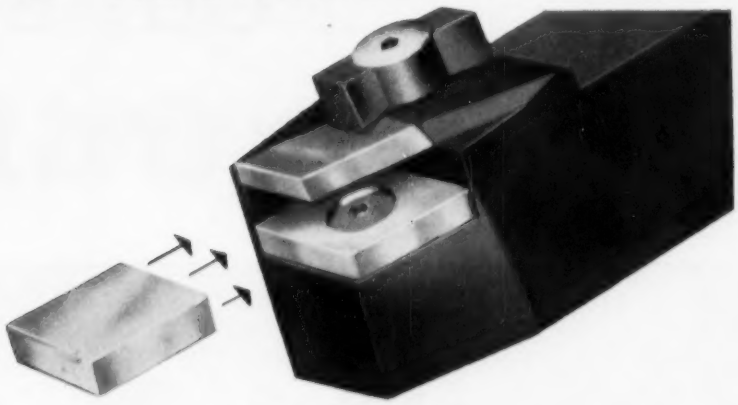
Horton Chuck, Div of E Horton & Son Co, Windsor Locks, Conn

Special-Duty Gearmotor

Sterling Slo-Speed brake-mounted gearmotor with zero-speed switch was developed especially for use with a high-speed "palletizer" made by Food Machinery & Chemical Co. Operating cycle of machine calls for motor to run forward and plug to a stop, applying the brake at the same time.

Zero-speed switch is mounted directly on the motor-shaft extension through the brake. As speed of motor approaches zero, the zero-speed

NOW! a complete line of *ALSIMAG CERAMIC INSERTS



STANDARDS

THROW AWAY CERAMIC INSERTS AND CHIP BREAKERS

for all sizes and styles of Wendt-Sonis mechanical type tool holders. They are available for both positive and negative rake holders.

Special shape ceramic tips are available. All tips can be metalized for brazing.

WRITE TODAY for new 8-page folder on Wendt-Sonis Alsimag Ceramic inserts and tool holders. Folder includes illustrations, dimensions and prices of ceramic inserts, chip breakers and "throw-away" type holders.

*Alsimag is a registered trademark of the American Lava Corp.

WENDT-SONIS

HANNIBAL, MISSOURI
ROGERS, ARKANSAS

WENDT-SONIS COMPANY
Dept. AM-556, HANNIBAL, MISSOURI

Please send me your new 8-page folder on ceramic inserts.

COMPANY

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CITY ZONE STATE

ATTENTION MR.

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THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS

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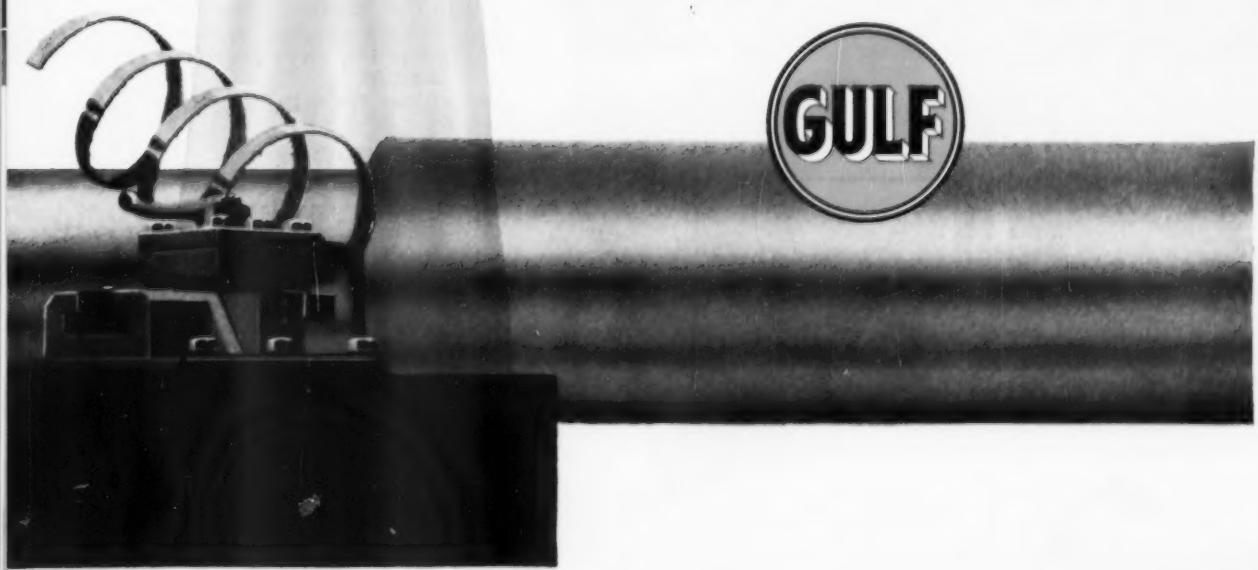
CUTTING OILS

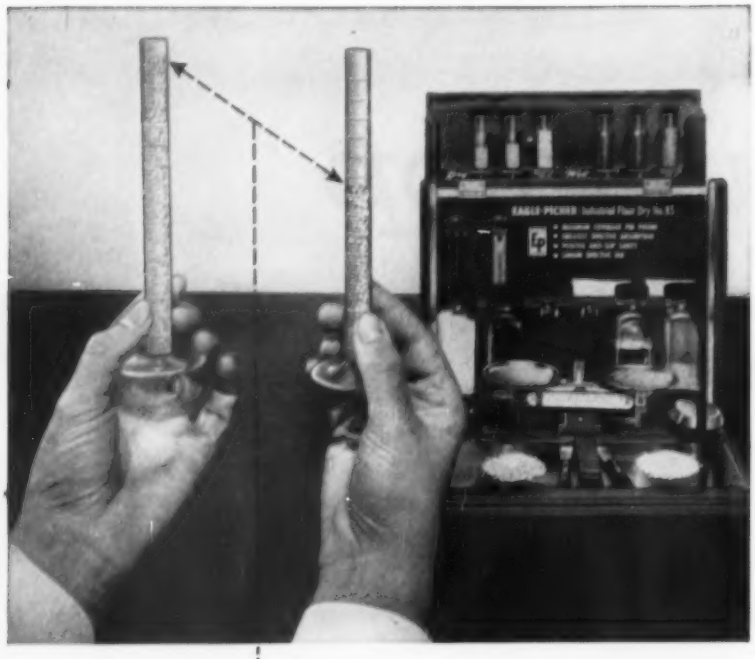
Gulfcut is the new brand name for Gulf's complete line of modern, up-to-date cutting fluids. Each Gulfcut oil is scientifically compounded to meet the most exacting requirements for tool life, accuracy of work, and surface finish.

This new line of Gulfcut Oils includes mineral-lard oils, sulfurized-mineral oils, sulfurized-mineral lard oils, sulfochlorinated-lard oils, and emulsifying oils—outstanding cutting oils that contribute to better results in every metal cutting operation.

Have a Gulf Sales Engineer show you how one or more of the Gulfcut line of cutting oils can help you get increased tool life and lower machining costs in your shop. Consult the telephone directory for the number of your local Gulf office.

Gulf Oil Corporation • Gulf Refining Company
1822 Gulf Building, Pittsburgh 30, Pa.





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IN YOUR OWN OFFICE, make this simple 15-minute test. Compare Eagle-Picher Industrial Floor-Dry to any other floor absorbent.

HERE'S WHAT YOU'LL PROVE TO YOURSELF about safe, skid-proof Eagle-Picher Floor-Dry: It's extremely insoluble, absorbs more oil and water. It goes further, provides much greater coverage. It reflects more light, brightens the work area. It's non-combustible, has no chemical reaction. It lasts longer, saves you money!

Since 1843 EAGLE EP PICHER

WRITE TODAY. Our Eagle-Picher representative will bring the portable laboratory to your office where you may make this test yourself. The Eagle-Picher Company, Cincinnati 1, Ohio.

switch disconnects motor winding from plugging reverse, but leaves the magnetic brake connected and applied. Motor repeats this cycle a number of times as cases are stacked on the pallet, and then has a reverse-running period, plugging to a stop while the pallet is unloaded or indexed to another position.

Sterling Electric Motors, Inc, 5401 Telegraph Rd, Los Angeles 22, Calif

Improved Electric Impact Wrench

No. 56 Thor SpeedWrench, a ½-in. square-drive universal unit, replaces Model 55. Designed for fast nut-setting and removal, it can be used, with attachments, for drilling in steel, wood, stone, or other materials, as a screwdriver, and for tapping, driving, or removing studs.

Finger-tip reverse button located in the handle behind the starting trigger permits one-hand operation. Current can be reversed instead of shifting commutator brushes. All electrical connections are concentrated in the handle. Unit is 9⅝ in. long over-all, weighs 7 lb, has a 1 7/16-in. offset. It develops forward and reverse speeds of 1900 rpm, delivers 1900 blows per minute. Price is $89.50.

Thor Power Tool Co, Aurora, Ill

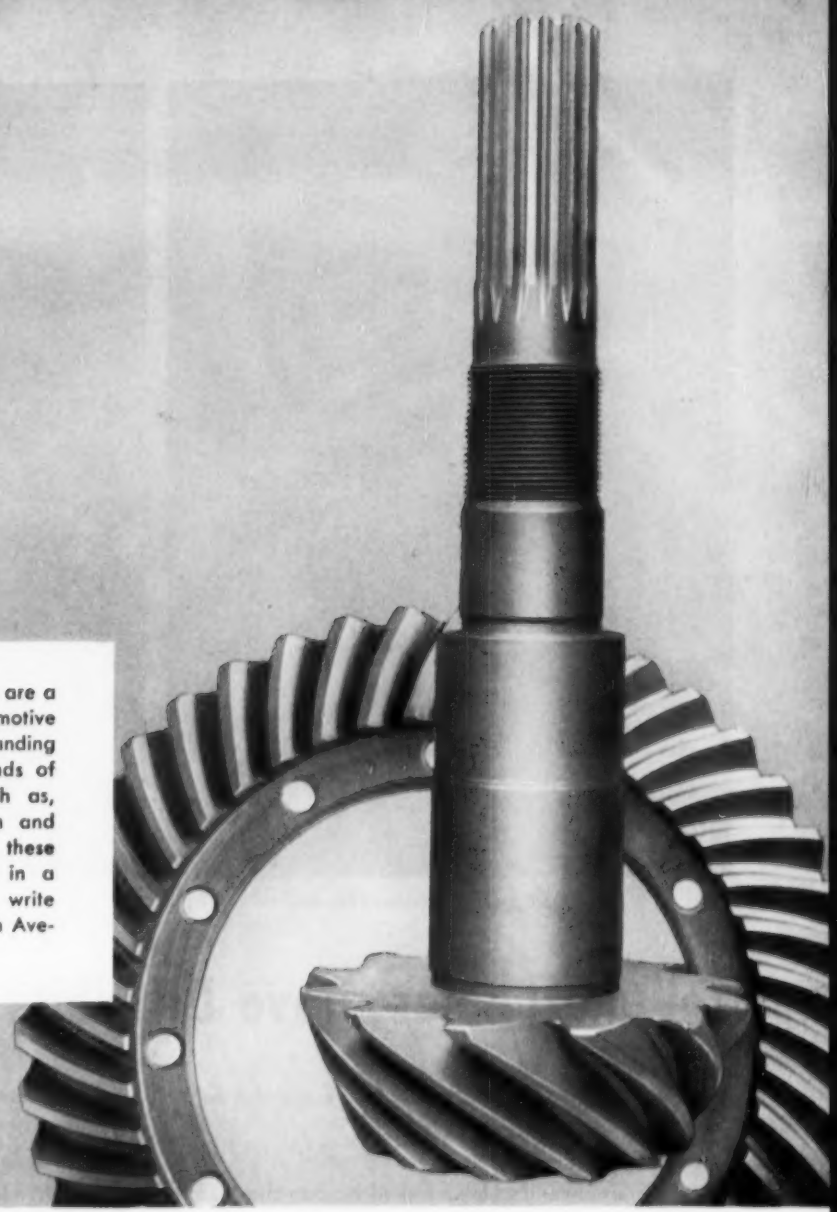
Epoxy Hardener

Promoter D-40 is said to be relatively non-toxic in view of its high boiling point and low order of reactivity. Masses up to 40 lb of clear resin have been prepared with no difficulty, according to manufacturer. Circuits and other devices requiring resin masses of 1 to 5 lb may be cured at temperatures between 140-160 F.

Curing cycle produces gelation at a very slow rate; polymer network thus formed is relatively strain-free. Product has no offensive odor, and no tendency to crystallize.

Furane Plastics, Inc, 4516 Brazil St, Los Angeles, Calif

"IT'S BETTER IF IT CONTAINS MOLY"



Moly carburizing steels with 0.5% Mo are a natural for components like this automotive ring-gear and pinion. They have outstanding properties that suit them to the demands of gearing and similar applications, such as, superior case hardness, low distortion and good machinability. Many features of these new carburizing steels are discussed in a recent technical article. For a reprint, write Climax Molybdenum Company, 500 Fifth Avenue, New York 36, N. Y., Dept. 12.

Molybdenum Carburizing Steels

MOLYBDENUM OFFERS THE ECONOMICAL KEY TO PERFORMANCE

Over the years, molybdenum carburizing steels have proved their merits in scores of applications and at every level of production.

Design engineers know moly steels for their uniform hardenability, toughness and wear resistance.

Production men know that moly steels are easy to heat treat, easy to machine.

Management knows that moly steels mean economy in fabrication, high performance in a wide range of end products.

Standard molybdenum carburizing steels are widely available. Higher moly analyses may be ordered in heat lots from a number of leading suppliers.

CLIMAX MOLYBDENUM

Paint sprayed cold often looks like this

Paint sprayed hot reduces fog, saves material

Telltale photos prove DeVilbiss cuts paint waste!

New Hot-Spray method creates less paint fog; saves up to 50% in material

By the application of controlled heat to the material – and spraying at far lower pressures – the new DeVilbiss Paint Heater solves the problem of spray fog, the major cause of spray-material waste. More paint reaches the surface; a heavier paint film can be attained with each application.

So, generally, one hot-sprayed coat covers better than *two or more* coats sprayed cold. Spraying time and material are often cut in half! And finishes? They dry faster, shrink less; come out glossier!

Usable for all types of products, the DeVilbiss Paint Heater can be *your* means to better finishing at lower cost. Call your DeVilbiss supplier, today, for an appraisal of your operation.

For full details, write for Folder F-286.

DeVilbiss Paint Heater permits Marinette Marine Corp., Marinette, Wisc., to effect multiple benefits in applying vinyl paints to U.S. Navy landing craft. Firm reports hot-spray system practically eliminates spray fog, objectionable fumes; allows heavier film build without sags; maintains trouble-free production rate.

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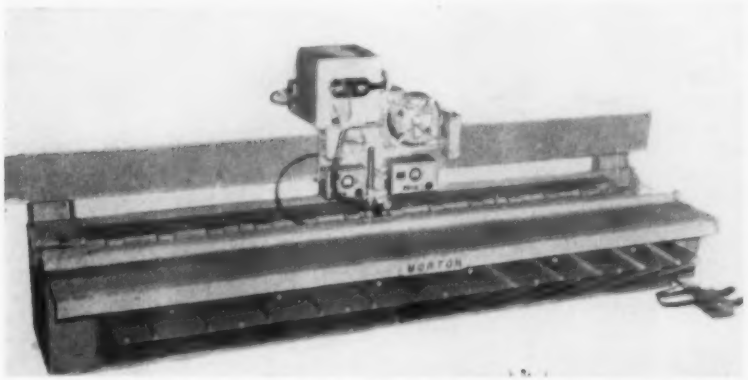
BRANCH OFFICES IN PRINCIPAL CITIES

New Bond for Diamond Wheels Triples Cutting Speed

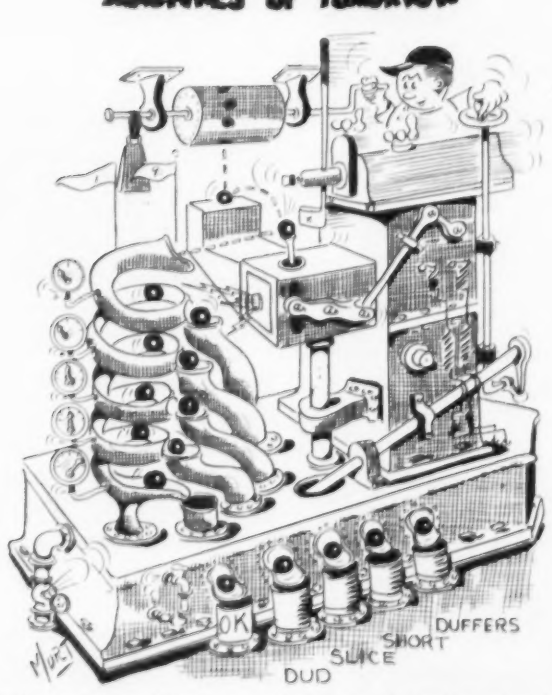
Manufacturer claims that diamond wheels bonded with Cera-Met cut 300% faster than metal bonded wheels. Cera-Met wheel reportedly does not glaze even if carbide and steel are ground at the same time. Wheel life is said to be as good or better than diamond vitrified bonded wheels.

Bond wets and adheres to each diamond grain; after diamond is worn flat, breakaway action releases the particle, exposing a fresh edge. This action is said to continue throughout life of the wheel so that grinding surface is always clean and sharp.

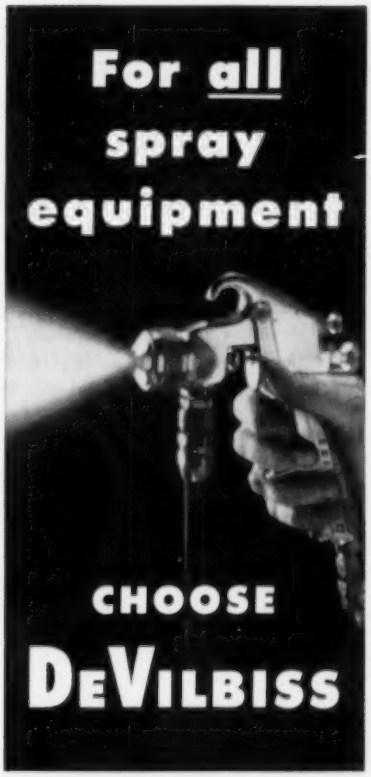
Clipper Diamond Tool Co, 21G W 46th St, New York 36, NY



STAKE WELDING MACHINE is Morton special which is a modification of company's standard Model A stake welder. Machine is designed for the automatic arc welding of flat stock, and includes side loading platforms with ball transfer rolls to aid in handling materials. Standard features include positive clamping, accurate gaging, and water-cooled copper back-up bar. Machine will handle flat stock of all types up to ¼-in. thickness. Any desired height and length can be built by request—*Morton Mfg Co, Broadway and Hoyt, Muskegon Heights, Mich*

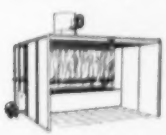


A Behemoth of extraordinary design to test the accuracy of chip-shots before being shot, a service that will be appreciated by the golfing trade. —Designed by Aprissi, Inc



Compressors – up to 22.6% more air per power dollar. ¼ through 15 hp.

Hose – air and fluid – specially fabricated for spray-painting use.



Spray Booths – full range of standard and specialized types.

Write for literature, or call your DeVilbiss supplier.

THE DEVILBISS COMPANY
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Another of the Reasons Behind Brad Foote Quality—

METALLOGRAPHY

• The heat treatment a gear receives is probably the most important single factor in determining its long range wear characteristics. Here at BRAD FOOTE we pride ourselves on having equipment designed to provide the widest possible variety of heat treatments.

• But in addition to standard heat treating and testing equipment we have a few extra safeguards. One of these, rather unusual in our business, is a complete Metallographic laboratory. Specialized equipment allows us to examine or photograph the grain structure of all of our metals, in order to determine the most effective methods of heat treatment and to serve as a check on the quality of finished work.

• Metallographic examination is just one of the many reasons behind BRAD FOOTE quality. Prove to yourself the savings this extra quality can mean. Let us quote on the gear requirements for your next program, without obligation.

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NEW!

AN INTERNAL BORE-FOLLOWING SURFACING HONE

FOR PRODUCTION
FOR MAINTENANCE
FOR TOOL MAKING

Widely used in the automotive industry—ideal for all metal working applications, for stationary or portable tool use. Fast uniform cylinder surfacing with full control and accuracy. Spring tension gives proper abrasive action and easy entry to bore—no resetting between cylinders. Capacity, 2" to 4½" dia. with quick-change abrasive cloths, 2½" to 5¼" dia. with replaceable carborundum stones (220 grit). Regularly supplied with flexible-cable joint, stiff shaft optionally available.

CF60—$7.45, with extra abrasive cloths. Carborundum stones, $3.60 per set.

Clark-Feather MFG CO.
122 W. Railroad, Fort Morgan, Colorado

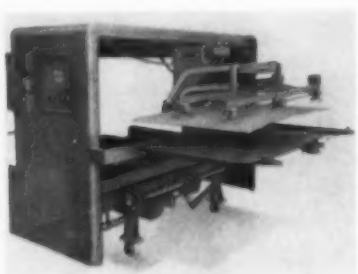
SEE YOUR TOOL SUPPLY HOUSE OR WRITE FOR LITERATURE

Temperite Convection Furnaces Have Range to 1350 F

Units are designed to assure temperature uniformity in all parts of the work chamber. Positive circulation of air is assured by high-speed fan and a special alloy baffle which directs airflow. Heat is transferred rapidly and uniformly from heating elements to the work.

Sturdily constructed furnace shell is insulated with preformed layers of graded insulation to reduce radiation loss. Electric heating units are placed on sides of work chamber, minimizing heat loss; elements are of highest grade coiled nickel-chromium wire held in ceramic refractories. Nine standard sizes are available. Details are contained in bulletin 355.

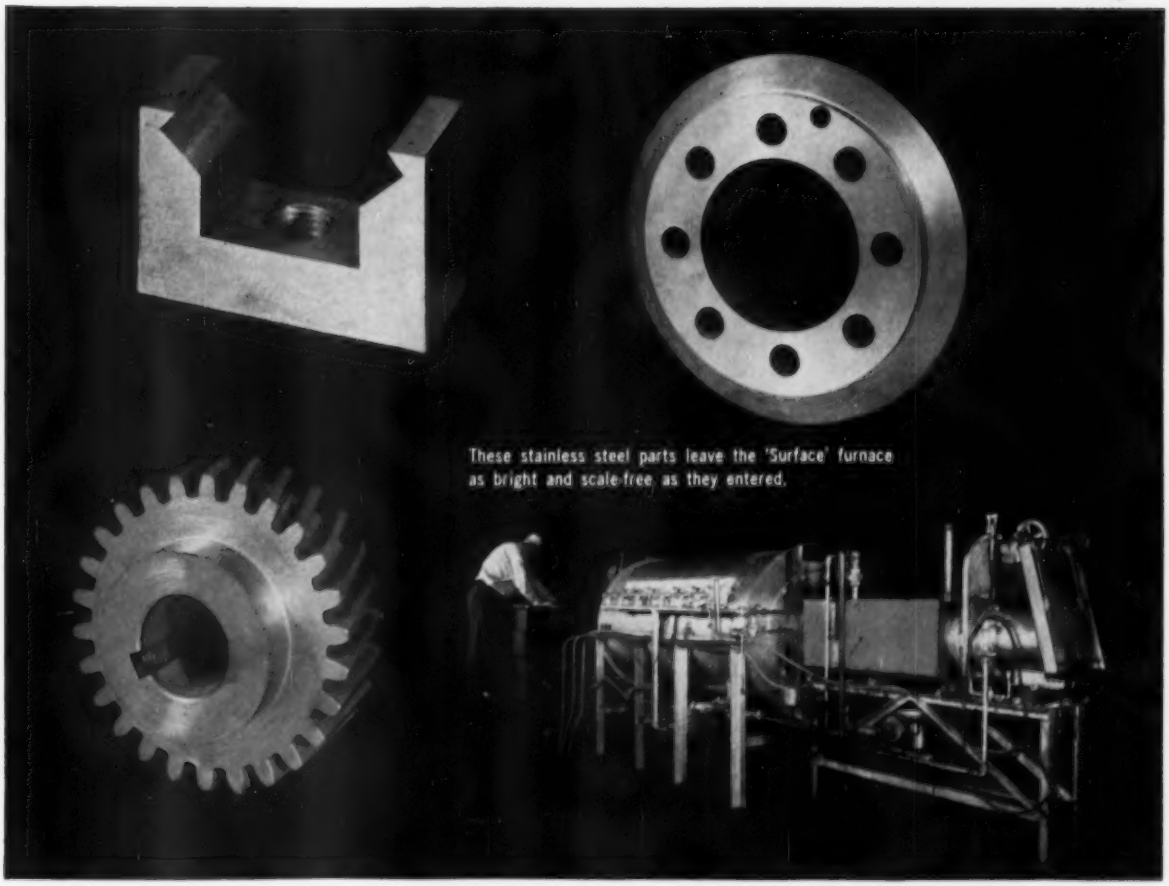
Hevi Duty Electric Co, Milwaukee 1, Wis.



Sheet Feeder Added to Hamilton Automation System

Designed to be incorporated in Hamilton Automation system for feeding, pulling, and positioning parts at the die press in heavy metal-stamping operations, sheet feeder is a standard unit which automatically feeds a single sheet of steel to a punch press.

Air-operated with 110v electrical controls, machine is capable of handling up to 30 steel sheets a minute, depending upon size of the blank. Unit will take sizes ranging from a



These stainless steel parts leave the 'Surface' furnace as bright and scale-free as they entered.

bright hardened stainless sells!

you can really sell bright hardened stainless and other high alloy steels, because they save money for your customers.

this has been demonstrated by the people at Syracuse Heat Treat Co., Syracuse, N. Y. In the two years since they installed this 'Surface' high temperature muffle furnace, they have sold their customers savings—cost cut $1.87 on one part . . . hand stoning operation cut from 30 to 5 minutes on another . . . delivery in half the previous time . . . tighter specifications met.

and you earn yourself, as the Syracuse people found out, because the furnace delivers parts clean and bright, and eliminates costly, time-consuming descaling operations. The market is good for the premium product this furnace permits. Why not tap it now?

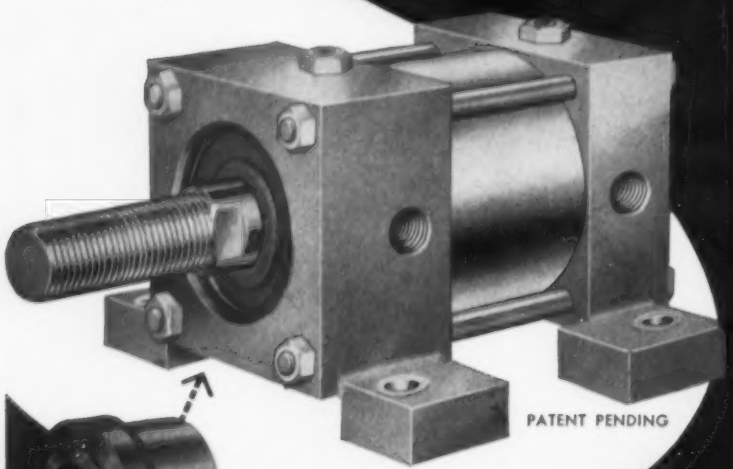
Send for Bulletin SC-164: Surface Combustion Corporation, 2365 Dorr St., Toledo 1, Ohio

Surface®
HEAT TREATING EQUIPMENT

SURFACE COMBUSTION CORPORATION

Also makers of Janitrol® automatic space heating and Kathabar® humidity conditioning units

*APPROVED HEAVY-DUTY AIR CYLINDERS for Automation



QUICK-CHANGE PACKING CARTRIDGE Cuts Downtime

Step up production with rugged, service-free, S-P Heavy-Duty Air Cylinders:

- Designed for 200 PSI
- Rolled steel end plates
- Extra long cushions
- Extra large, hardened piston rod
- Minimum mounting and envelope dimensions
- 5 types of mountings
- 8 bore sizes, 1½" to 6"
- Double porting
- Interchangeable check and cushion valves
- Quick-change packing and bearing cartridge

* S-P Automation Cylinders were designed expressly for a large automobile manufacturer. They are thoroughly proven for automation and general heavy-duty applications. Prompt deliveries. Send for Catalog 109. For S-P standard Air Cylinders, request Catalog 102. The S-P Manufacturing Corp., 12415 Euclid Ave., Cleveland 6, Ohio.

THE S-P MFG. CORP. — Cleveland
A Bassett Company
PRECISION PRODUCTS SINCE 1916
AIR AND HYDRAULIC CYLINDERS • POWER CHUCKS • ROTATING AIR CYLINDERS
COLLET AND DRILL PRESS CHUCKS • AIR PISTONS, VALVES AND ACCESSORIES

blank 8 in. in diameter to a sheet of size 48 x 144 in.

Feeder is self contained and completely movable. Controls can be interlocked with those of press and with those of its sister units.

Hamilton Automation, Inc, Hamilton, Ohio

Vapor Spray Degreaser

Circo Model OP2-D30 vapor spray degreaser, of circular design, features unobstructed tank walls with recessed condensate trough for effective solvent reclamation. Trough serves as a reservoir for distilled, pure solvent, which is fed by means of a leakproof pump to a flexible hose and spray lance with fan-type nozzle.

Interior of tank, as well as other critical surfaces, is zinc metallized for protection against corrosion. Stainless-steel construction is also available.

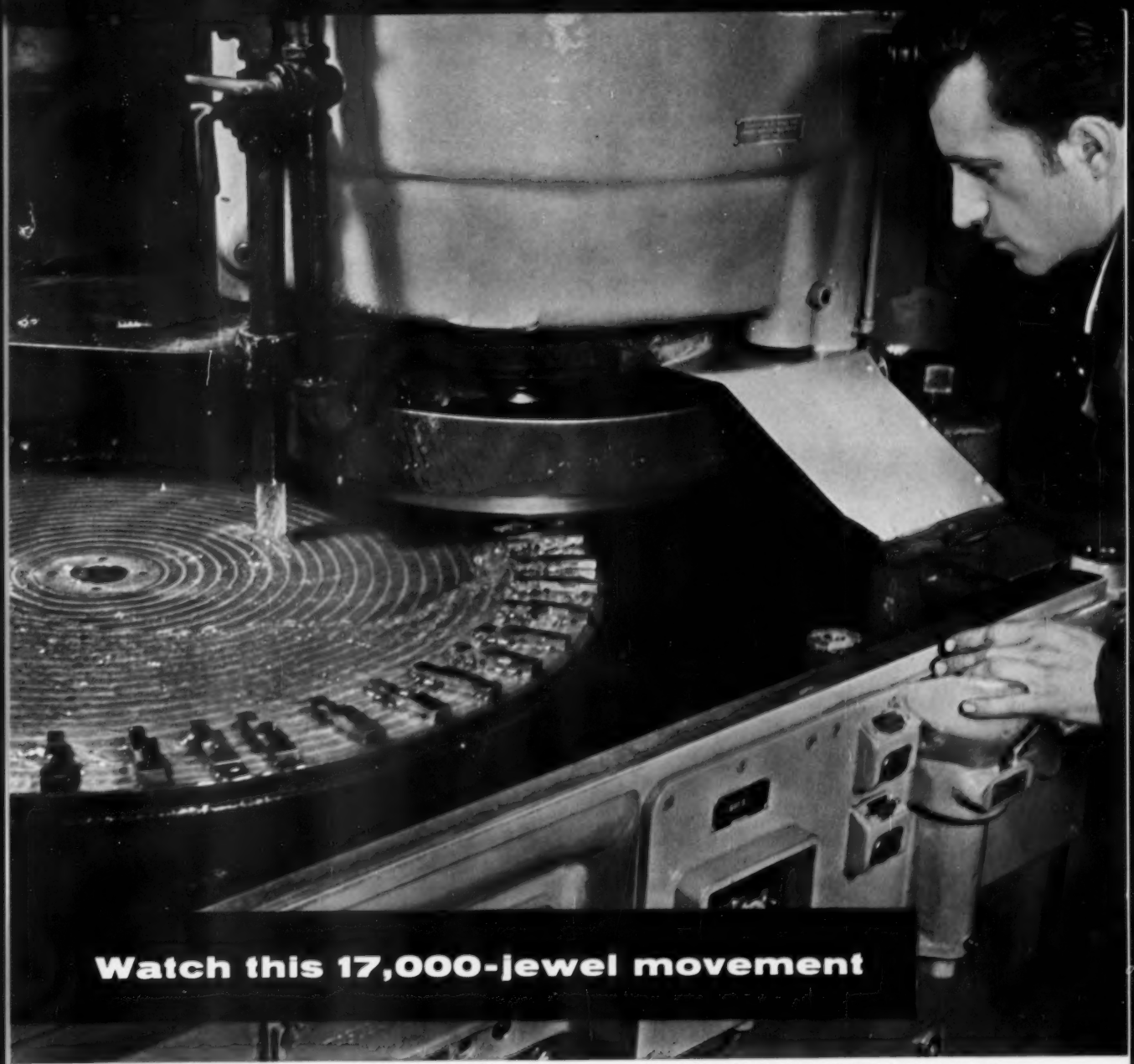
Model is available with steam or electric heating systems, including a liquid-sump safety thermostat on the electric unit. Delivered ready for installation, machine has one-year guarantee against defective parts.

Circo Equipment Co, Terminal Rd & Central Ave, Clark (Rahway), NJ

Norelco X-ray Bearing Analyzer

Designed specifically for quantitative analysis of lead-tin alloy platings on crankshaft bearings, Norelco bearing analyzer utilizes basic principle of the X-ray spectrograph. Instrument analyzes platings on the interior surface of bearings with an accuracy of 1% for lead and 1% for tin. Average time for analysis is 90 sec.

As bearing is rotated mechanically, the beam from the X-ray tube



(Sliding guard removed, wheel guard raised, and coolant flow reduced.)

PHOTOGRAPHED AT COLE CARBIDE INDUSTRIES, ROYAL OAK, MICH.

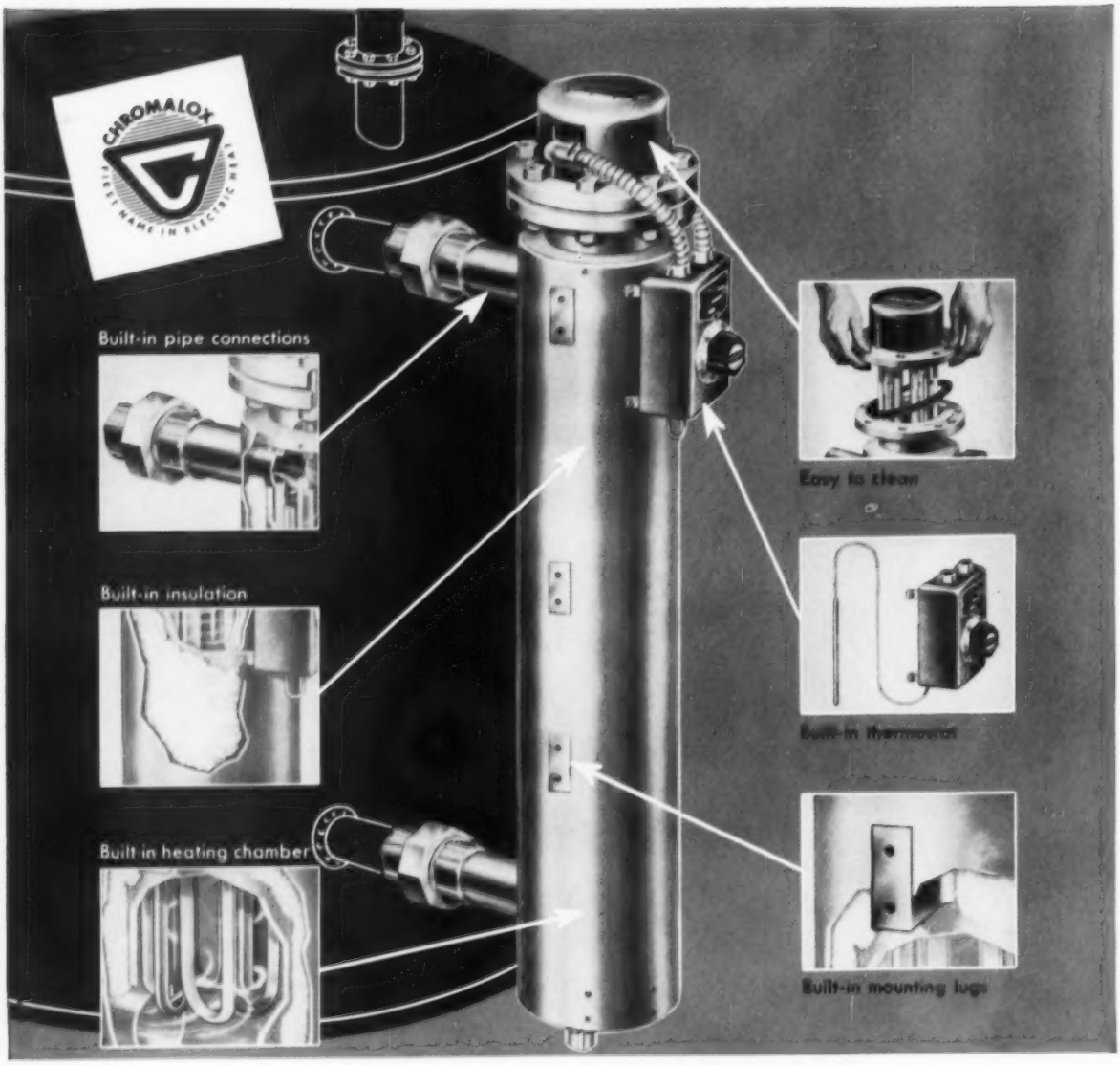
CARBORUNDUM's Diamond Wheels are by far your best choice for grinding cemented carbide tools. On this rotary table surface grinder, a B7 Resinoid Bond Diamond Wheel permits maximum production rates without risk of checking or cracking the carbide . . . cuts exceptionally free and cool . . . requires less pressure between wheel and work to achieve accurate size control. CARBORUNDUM also produces a top-quality line of metal bond Diamond Wheels for offhand work and cutting off. Ask your CARBORUNDUM Distributor or salesman for your free copy of Form A-1208, an authoritative 40-page booklet on "Grinding Cemented Carbides". Or write The Carborundum Company, Niagara Falls, New York. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ontario.

Through application "know-how" and product quality

CARBORUNDUM

REGISTERED TRADE MARK

continually puts more sense in your abrasive dollar



Compact, packaged Electric heating for Liquids and Gases!

Chromalox Electric Circulation Heaters are completely packaged heat exchangers designed for a wide variety of liquid and air heating jobs. In them, you get a complete, compact heating package ready for quick, economical installation. All you do is make the necessary pipe and electrical connections.

What's more, you get all the advantages of electric heat—including accurately maintained heat at the temperatures you select, instant heat-up, without elaborate facilities . . . and high efficiency because you generate heat right at the job.

Compared with fuel-fired systems, the low original cost and operating expense of Chromalox Electric Circulation Heaters helps you realize real dollar savings. There's no expensive firing and upkeep cost.

Whether you are heating water, oils, steam, air or heat transfer media, call your Chromalox representative—he's the man with the electrical answer to your heating problem.

For the full story on Chromalox Electric Circulation Heaters, write for a copy of Bulletin 701.

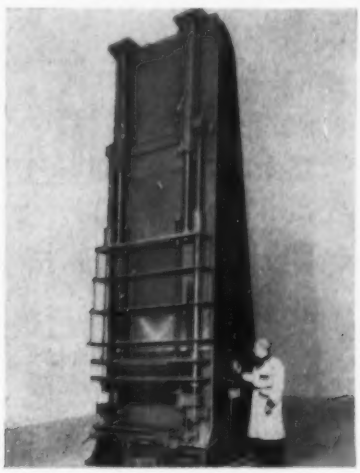
Edwin L. Wiegand Company

7577 Thomas Boulevard, Pittsburgh 8, Pa.

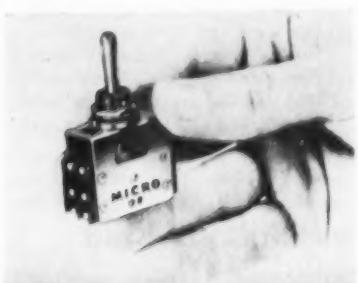
strikes the central interior surface area at an oblique angle. This action causes the plating to fluoresce and produce secondary radiation whose characteristics are influenced by the amount of lead and tin in the plating.

Secondary rays pass through a coarse collimator, strike an analyzing crystal, pass through a fine collimator, and are finally detected by a Geiger counter tube. Pulses then go through electronic circuits where the intensity is measured. By comparing X-ray intensities with those for known standards, it is possible to determine whether platings conform to specified lead-tin ratios.

Research & Control Instruments Div, North American Philips Co, Inc, 750 S Fulton Ave, Mt Vernon, NY



INCLINED-FRAME TUBE EXPANDING MACHINE expands and sizes copper tubing in evaporator and condenser finned coil assemblies up to 72 in. long in 15 sec. The 23-ft-high unit incorporates hydraulically controlled tilting work fixtures—*Walter P Hill, Inc, 22183 Telegraph Rd, Detroit 19, Mich*



Toggle Switch Developed for Electronic Equipment

Toggle switch with an "electrical memory," designated 21AT1, is a

an ACCO product

ACCO Registered* Sling Chains

NEW!
Shaped Section Master Link
Holds its form under loads up to 18% greater.
NEW!
Accoloy X-Weld 125 Chain
Welds as strong or stronger than alloy material. Welded area 2¼ times conventional size area.

* Trade Mark Registered

NOW—Better and Safer than Ever!

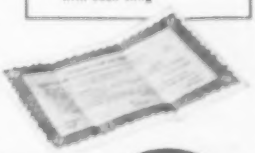
• ACCO *Registered* Chain Slings—long recognized as the standard of excellence—now give users a double bonus of safety and quality. They incorporate ACCO's new Shaped Section Master Link plus ACCO's sensational Accoloy X-Weld 125 chain.

The new Shaped Section Master Link, without any increase in weight, withstands deformation under loads up to 18% greater than a standard round section can. And the Accoloy X-Weld 125 chain—with its extra-strong, king-size welded area and its non-kinking feature—assures extra ruggedness and better service.

Because of these two spectacular improvements, there is more reason than ever for standardizing on ACCO *Registered* Slings. For additional interesting information, call your ACCO *Registered* Distributor—or write our nearest District Office.

WHAT "ACCO REGISTERED" MEANS . . .

1. The best material
2. Unit safety factor (on bodies, rings, links, hooks)
3. Proof test of complete sling to twice the working load limit
4. Actual field service test of each design
5. Metal identification ring on each sling
6. Signed Registry Certificate with each sling



ACCO

American Chain Division

AMERICAN CHAIN & CABLE

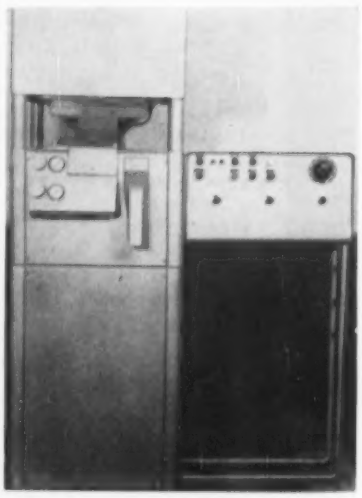
York, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn.

plus Rings Links Hooks

four-pole assembly with one pole for indicating which circuit was last operated. Switch is primarily intended to simplify some basic circuit designs of remote control equipment, computers, and aircraft control panels, and may also have application in counting devices, conveyor controls, and similar industrial systems.

Assembly uses 3 single-pole, double-throw basic switches and one single-pole-double-throw "memory" switch. In application, memory switch indicates through a pilot light or buzzer which circuit was last actuated.

Micro Switch, Div of Minneapolis-Honeywell Regulator Co, Freeport, Ill



Auto-Electronic Parts Counter

Model EC electronic counter is designed for the automatic counting in predetermined quantity lots of small parts such as screws, nuts, screw machine parts, and plastic parts. Maximum counting speed is determined by the dimension of the part being counted and packaged. Maker reports that one operator can handle as many as 8 or 10 units.

In operation, parts are loaded manually into the 4-cu-ft hopper located at top center of the unit. Adjustment is then made to set the unit specifically for the part to be counted, by installation of an insert which bridges a gap between the bowl feeder and the discharge chute. When parts pass over insert they are separated in single-file travel and break a photo beam to register count. Number of pieces to be counted is then set by means of dials on front of unit; setting range is from 1 to 9999 pieces.

Counter may be equipped with additional control features which in-

Get smoother, more accurate *holes* with "ground-from-the-solid"

ACE

Drill Length AND *Chucking*

REAMERS

More holes faster . . . and at lower cost! That's what you want from a reamer, and that's what you get from Ace Drill Length and Chucking Reamers! They're made of pre-hardened H.S.S. and produced by the Ace "ground-from-the-solid" process. This gives them their highly polished right-hand spiral flutes . . . plus keener, longer-lasting cutting edges that produce smoother, more accurate holes. They're economical to use, too, particularly the drill length reamers. Because, with flutes nearly twice the length of chucking reamers, they can be re-ground more times for longer useful life. Next time you need reamers, ask your distributor for "ACE". If he doesn't have them, send coupon for complete details.

ACE DRILL CORPORATION
Adrian, Michigan

Gentlemen: Please send me your Catalog No. 52-A containing complete information on ACE "Ground-from-the-Solid" Drills and hardened H.S.S. drill blanks.

NAME _____

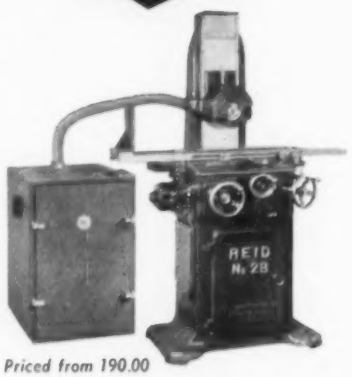
COMPANY _____

ADDRESS _____

CITY _____ STATE _____

ACE DRILL
ADRIAN, MICHIGAN
ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

machines last longer...



Priced from 190.00

wear reduced as much as **80%** with easy-to-move

TORIT DUST COLLECTORS

Dust causes wear, damages bearings, bedways, slides and saddles and other "sensitive" machine parts. Clean machines hold close tolerances better and need re-grinding or alignment only ⅕ as often. In five years, users of Torit dust collectors save up to $1,600 in re-grinding the ways of the average grinder—and save hundreds of dollars *more* in down-time.

MANY COMPACT MODELS . . . all self-contained. Unitized for custom installation. More economical, usually more efficient than central (built-into-the-building) systems. For more information, write today to . . .

TORIT
MANUFACTURING COMPANY

Sweet's

Dept. 407
311 Walnut Street,
St. Paul 2, Minn.

MICRO *precision switches*

...THEIR USE IS A PRINCIPLE OF GOOD DESIGN

High-capacity switch enclosed in rugged aluminum housing.

Compact size permits mounting in small space.

A two-circuit, double-break contact arrangement.

Here is a compact 2-circuit limit switch that meets a wide variety of plant applications

This MICRO precision switch is designed to meet every requirement for a compact 2-circuit switch for use as a limit, safety or interlock switch on complex production equipment.

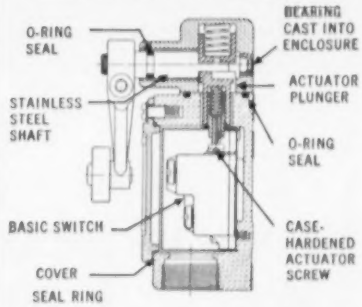
It has small size, extreme versatility, precision, reliability and ruggedness. All moving parts and the switching chamber are completely sealed, protected from wear or becoming fouled. Field adjustability permits its use in any type of application or location.

Two-circuit contact arrangement allows flexibility in circuit design. Reliability of the precision, snap-action unit assures accurate repeat operation throughout many millions of hard, fast actuations. Although small and compact in size, this switch is not only a precision instrument. It is designed and built to stand the most severe abuse.

The electrical rating is: 10 amperes 120, 240 or 480 volts a-c; ½ H.P. 115 volts a-c; 1 H.P. 230 volts a-c; .2 ampere 115 volts d-c; .1 ampere 230 volts d-c; .04 ampere 550 volts d-c. Pilot duty rating is: 600 volts a-c, max.

Like many other precision switches in the MICRO SWITCH line, this versatile 2-circuit switch is an ideal component for installation on present plant equipment. MICRO precision switches make production machinery safer, more automatic and more productive.

Seals Provide Maximum Protection



Sealing is provided by use of O-ring seals on the actuator shaft and between the actuator head and the housing. A synthetic rubber ring seal is provided for the cover. These seals provide maximum protection against entrance of dust, oil and other liquids. The switch meets NEMA specifications for an oil-tight pilot device.

Adjustable Head Assembly

The switch is easily mounted in almost any location. The user can remove the head and locate it in any of 4 positions (as illustrated).

Field Adjustable Actuator

The roller arm actuator is field adjustable through 360 degrees, positively locking in any position. Actuators are assembled to operate in either direction. They can also be converted to operate in one direction only, clockwise or counterclockwise

Send for new catalog 83 on industrial enclosed switches.

MICRO precision switches are sold by distributors in key cities everywhere. Look under "Switches, Electric" in the yellow pages of your phone book.

MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

In Canada, Leaside, Toronto 17, Ontario • FREEPORT, ILLINOIS

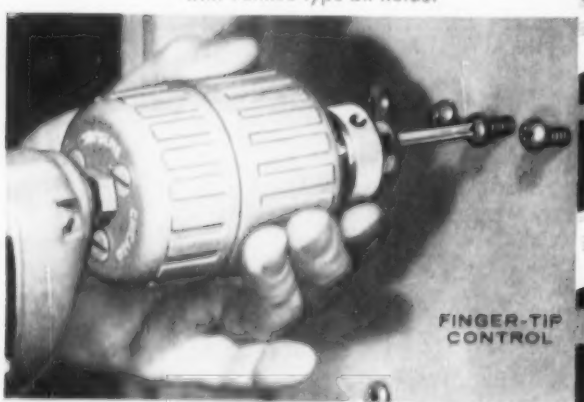
Greatest new tool in years for maintenance and production

a high quality, low cost
REVERSIBLE
SPEED REDUCER

Fits all portable drills . . . reduces speed, increases torque seven times. Ask your distributors to show you the . . .

Supreme Versamatic

PROFESSIONAL MODEL
No. 4000-P
with Yankee-type bit holder



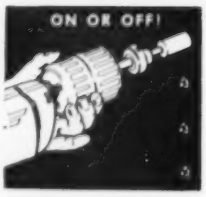
COMPLETE 14-PIECE SET . . . ONLY $24.95

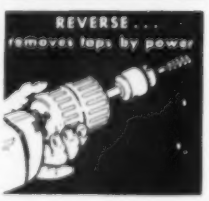
Engineered and manufactured
by the makers of

Supreme Chucks
BRAND

The line that's UP FRONT on
America's leading power tools

SUPREME PRODUCTS, INC., 2222 S. CALUMET, CHICAGO, ILLINOIS





corporate automatic feeding and discharge onto conveyors.

Pennsylvania Scale Co, PO Box 536, Lancaster, Penna

Goodyear Liquid-Air System for Spray Coolants and Lubrication

Liquidaire system is specially designed for toolroom and single-point metal cutting and stamping operations. Ejector, which can be liquid or air controlled for wet or dry-spray fluidity, is built for swivel adjustment and fitted with nozzle extensions from 2 to 24 in. in length, easily fitted to required position.

Two models are available: P-1-SCV single-control unit handles both liquid and air; P-1-DCV (illustrated) has one control for air and one for liquid. Both models have a pressurized tank of 1-gal capacity, tested at 150 psi; quick-bleed back-air-pressure control valves; and full-tank-length liquid level gage. Ejector supply hose from reservoir tank is 5 ft long and is of flexible vinyl hose encased in protecting metal conduit.

H J Goodyer, 1400 Wabansia Ave, Chicago 22, Ill

Anionic surface-active agent, known as Isomal 265, has been developed for use as a wetting agent, rewetting agent, penetrant, detergent, and emulsifier. Fluid is a concentrated sulfonated-ester type of liquid with a variety of applications in cleaning, polishing, and buffing operations. Clear in appearance, fluid has a neutral pH factor and a specific gravity of 1.088 at 60 F. It is reportedly 65% active and mildly pleasant in odor. Solution is compatible with both non-ionic and other anionic agents, is stable at temperatures up to 210 F, and has no upper or lower cloud point. Product is available in 55-gal drums.

Johnson-March Corp, Chemical Div, 1724 Chestnut St, Philadelphia, Penna

Now available... new hollow aluminum bar stock

Harvey Aluminum hollow bar stock is now available for a wide variety of hollow-part machining jobs. The new bar stock offers material savings, speeds production, and drastically cuts chip handling and scrap waste. Made of a special Harvey aluminum alloy, the new bar provides exceptionally high yield strength and corrosion resistance, has excellent machinability and surface finish. For *most* applications, the cost of hollow aluminum bar is 20% to 30% *lower* than conventional solid bar . . . . because the hole is already there!

It will pay you to immediately investigate the wide range of sizes available. Write or call today to have your Harvey field engineer show you how to save time and money with the new hollow aluminum bar stock. *Harvey Aluminum, Torrance, Calif. Branch offices in principal cities.*

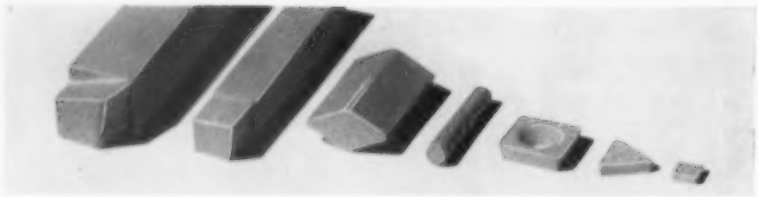
Harvey is a leading independent producer of quality aluminum products. Extrusions in all alloys and in all sizes, special shapes, press forgings, hollow sections, structurals, rod and bar, forging stock, pipe, tube, impact extrusions, aluminum screw machine products and related products. Harvey is also producing similar items in titanium and steel.

Making the most of aluminum...

for everyone

HARVEY Aluminum

HARVEY ALUMINUM SALES, INC., TORRANCE, CALIFORNIA • BRANCH OFFICES IN PRINCIPAL CITIES



Priced Under Cemented Carbides

DIAMONITE OXIDE CUTTING TOOLS

Do Many Jobs Better on TODAY'S Machines

If you hesitate to try the new so-called "ceramic" cutting tools because you feel they would be too expensive to "pay-off" on your equipment or that they can be used to advantage only on "machines of the future," consider these facts about Diamonite Oxide Cutting Tools.

Diamonite Oxide Cutting Tools, in most forms and sizes, actually are priced under cemented carbides.

While realization of their full potential hinges on complete redesign of machine tools to provide much greater power and rigidity and ultra-high surface speeds, there are many operations on which they can be used advantageously on existing equipment. Here are a few examples gained from more than thirteen years experience in actual production operations and extensive tests.

For Better Surface Finish

Being non-metallic, Diamonite Oxide Cutting Tools will not weld to metals at temperatures generated in machining. Tearing is eliminated and the resultant fine, characteristically bright finish approaches that obtained by grinding.

Machining Abrasive Materials

Thirteen years of actual production experience prove conclusively that Diamonite Oxide Cutting Tools greatly outwear those made of other commercial tool materials in machining abrasive plastics, ceramics, graphitic products and other abrasive materials, often permitting much higher surface speeds.

For Longer Tool Life

On "automated" machines and other operations where shutdowns are particularly costly, the great wear resistance of Diamonite Oxide Cutting Tools can be of inestimable value in maintaining production schedules and lowering costs.

Speeding Up Multiple-Operation Machines

On multiple-operation machines, speed of all operations is restricted by surface speeds possible with existing tooling on largest diameters. Because they won't burn up at high speeds, it often is possible to greatly accelerate production by using Diamonite Oxide Cutting Tools on large diameters thereby permitting all operations to be speeded up.

Eliminating Contamination of Work Materials

Being non-metallic, they cannot leave deposits which conduct electricity on machined surfaces of work materials to be used for electrical or dielectric insulation. They are chemically inert and can also be used safely with work materials which become chemically unstable when in contact with metals at high temperatures.

For Faster Machining

Power may not be available to permit use of the very high surface speeds possible with Diamonite Oxide Cutting Tools while maintaining feeds used at lower speeds with other tools. It often is possible, however, to use top r.p.m. of the machine with somewhat lighter feeds to obtain a much higher rate of material removal with a bonus of better finish.

Eliminating Coolants

Being themselves oxides, cutting edges of Diamonite Oxide Cutting Tools will not burn up at elevated temperatures generated by high speed machining. Unless required to protect the work, use of coolants with all the trouble, mess and cost involved, may be eliminated.

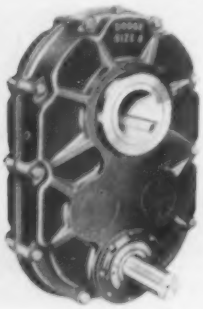
You Owe it to Yourself to Try

DIAMONITE
OXIDE CUTTING TOOLS

Diamonite Oxide Cutting Tools are available in the form of standard turning tools, blanks, standard mechanically-held 1¾" inserts and "throw-away" lozenges in the four common shapes and in all popular sizes. They are stocked by leading distributors in important centers who will be pleased to furnish prices, suggested tool geometry and hints for best machining practice.

You may be missing important opportunities for cost reduction and product improvement by not trying them. Why not contact your Diamonite distributor today?

DIAMONITE PRODUCTS DIVISION
UNITED STATES CERAMIC TILE COMPANY
CANTON 2, OHIO



New Torque-Arm Speed Reducers

Dodge Manufacturing Corp has added two new shaft-mounted models to its Torque-Arm line. Size No. 8 in the double reduction series has a capacity of 60 hp at 100 rpm, AGMA rating, and can be mounted on shafts up to 5 in. in dia. No. 11 has capacity of 1.3 hp at 100 rpm.

Reducers are mounted directly on the shaft, and the Torque-Arm is fastened to any fixed object for anchoring. Unit is driven through a V-belt drive. Dodge Taper-Lock sheaves permit any speed ratio desired. Details contained in bulletin A-637.

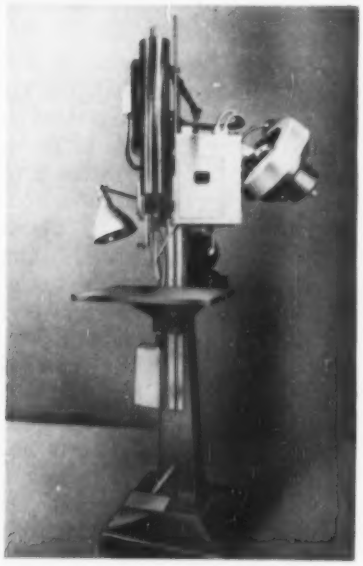
Dodge Manufacturing Corp, Mishawaka, Ind

Bonded resistance-type strain gages made of metal foil for use at normal atmospheric temperatures are offered for experimental use on a no-guarantee basis, in kits including 20 gages, cement, working tools, and instructions. Gages consist of a 0.0005-in.-thick copper-nickel foil grid on an epoxy-resin backing. Active grid dimensions are 1 x 11/32 in., and mounting dimensions are 1½ x ½ in. Nominal resistance is 119 to 121 ohms. Gage factor is approximately 2.20. Application procedure is roughly the same as for SR-4 wire gages. Foil-type gages are made under license with Technograph Printed Electronics, Inc.

Baldwin-Lima-Hamilton Corp, Philadelphia 42, Penna

Black protective coating for protecting metal, wood, or concrete is offered under trade name Everwear J-41-B. According to maker, paint remains elastic, permitting expansion and contraction with metal during extreme temperature changes. Paint reportedly does not crack, check, chip, flake, or peel, and is adaptable to brush or spray application. It is packaged in 5-gal pails and in 30- and 55-gal drums.

Maintenance, Inc, Wooster, Ohio



Automatic Socket Setscrew Feeder

Bristol device for the automatic hopper feeding of standard socket setscrews makes possible feed rates up to 2700 per hour, limited only by the rate at which the screwdriver can be operated.

Unit can feed screws of various sizes with only moderate adjustments. Finger adjustments enable operator to switch from one length to another; to go from one diameter to another, a few feeder tubes are changed.

Bristol Co, Waterbury 20, Conn

Heavy-Duty Tumbling Barrels

Lorco Series 300 tumbling barrels are built for precision finishing of large loads weighing from 700 to 3800 lb. Line includes six octagonal barrels of one and two compartments, ranging in total capacity from 6.9 to 36.6 cu ft. Barrel diameters are 30 and 36 in.; lengths run from 16 in. up to 5 ft.

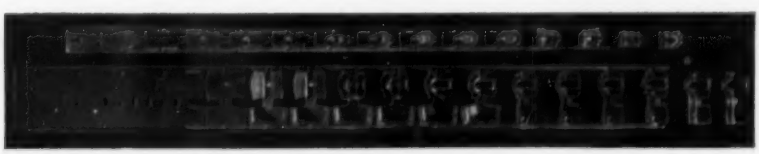
Oversize Reeves motor drive is

60 CALIBER LINKS FOR THE HIGHEST CALIBER PRODUCTION!

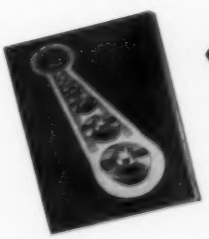
Stations by the dozens . . . tolerances to the ten thousandths . . . production in the millions . . . with progressive dies by

B. Jahn

60 caliber single and double loop links . . . produced by the millions — and hundreds of millions — and all must be absolutely identical, accurate! These stringent specifications demand the finest dies and diemakers — that's why B. Jahn was selected. The master toolmakers and engineers at B. Jahn built a 13 station and 16 station progressive die that formed the intricate components from heavy SAE — 1055 steel. Million plus runs . . . precise fidelity . . . and lasting economy . . . were engineered into every die — and verified by "production proving" in the B. Jahn plant before delivery. Whatever your product, your problem — B. Jahn die making ingenuity can help you deliver better goods . . . in less time . . . at less cost.



Die ribbons showing 13 and 16 stations necessary in producing tremendous runs of shell loop links!

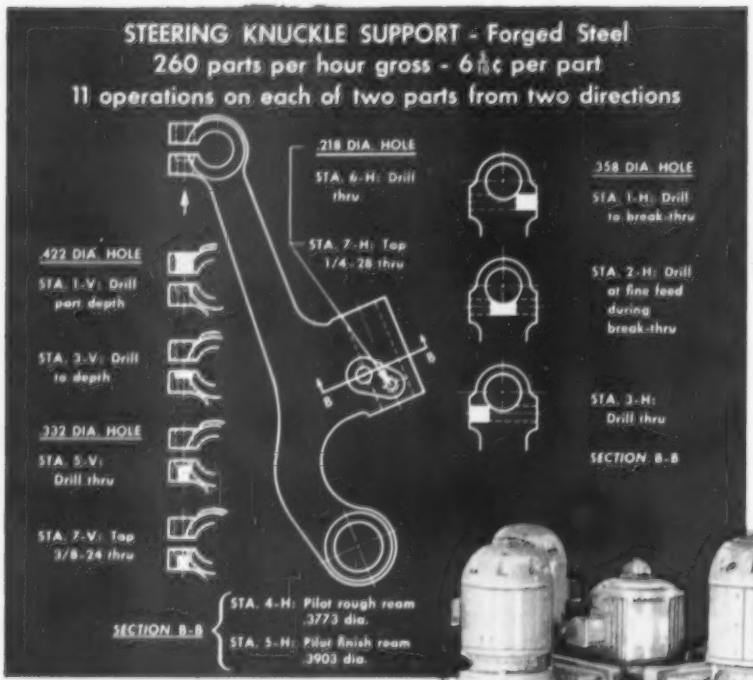


NOW AVAILABLE! The brand new B. Jahn brochure — lavishly illustrated — colorful — fact-packed! Send for your copy today!

B. Jahn

THE B. JAHN MANUFACTURING COMPANY, NEW BRITAIN, CONNECTICUT

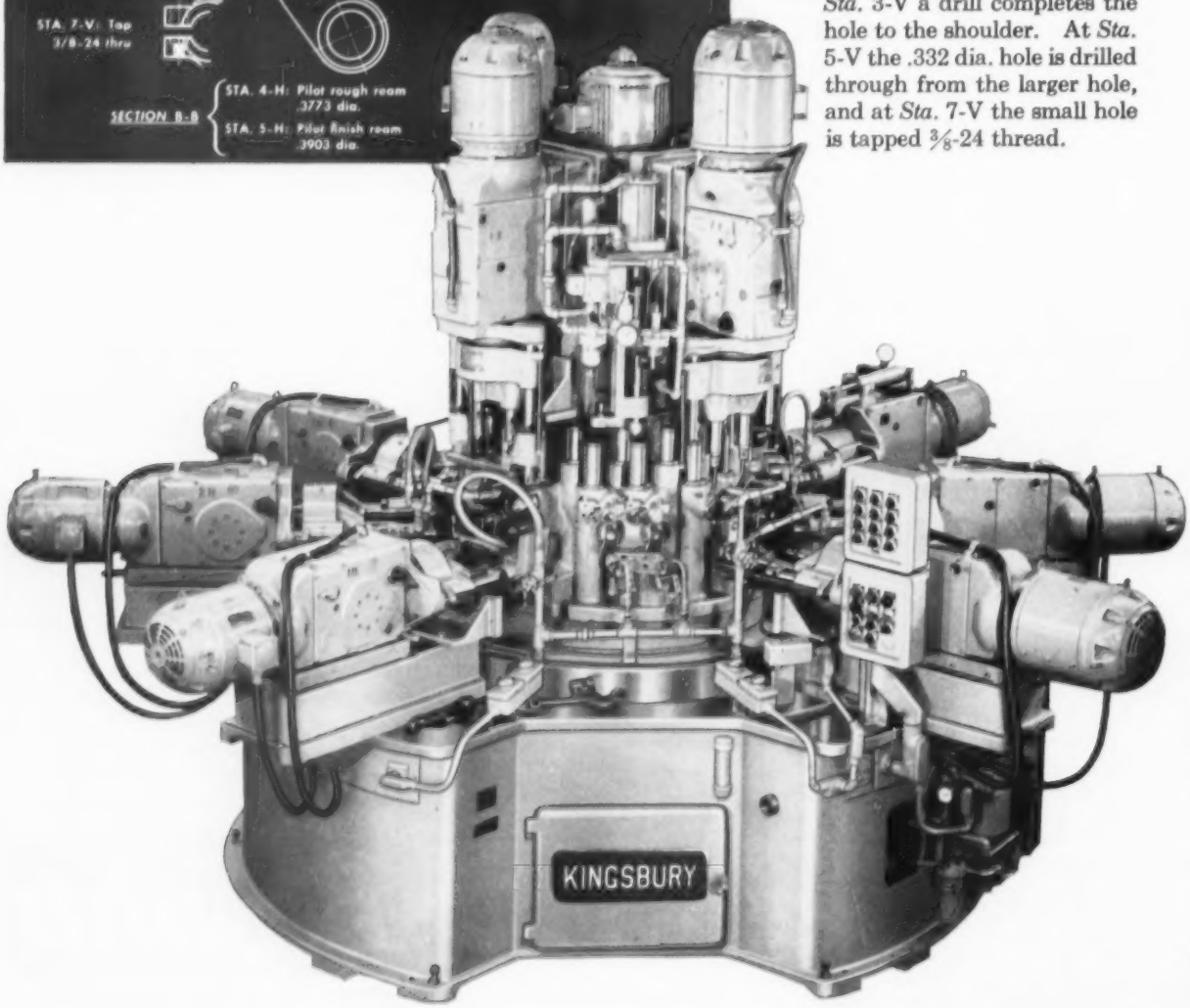
Where slow-down speeds-up "Operations Kingsbury"


STEERING KNUCKLE SUPPORT - Forged Steel
260 parts per hour gross - 6½c per part
11 operations on each of two parts from two directions
.218 DIA. HOLE
STA. 6-H: Drill thru
STA. 7-H: Tap 1/4-28 thru
.358 DIA. HOLE
STA. 1-H: Drill to break-thru
STA. 2-H: Drill at fine feed during break-thru
STA. 3-H: Drill thru
SECTION B-B
.422 DIA. HOLE
STA. 1-V: Drill part depth
STA. 3-V: Drill to depth
.332 DIA. HOLE
STA. 5-V: Drill thru
STA. 7-V: Tap 3/8-24 thru
SECTION B-B
STA. 4-H: Pilot rough ream .3773 dia.
STA. 5-H: Pilot finish ream .3903 dia.

Drill three holes, ream one, tap one . . . This *is* a simple job — for a Kingsbury, but the part must be worked on by 11 units at seven working stations to insure uniform accuracy and production.

In order to produce 260 pieces per hour gross, each work-holding fixture holds two parts, and each unit has an auxiliary head and works on a hole in each part.

The blueprint at the left tells the story. Notice the .422 dia. hole in the pinch-bolt bearing. This section required four operations from the *vertical* position: At *Sta.* 1-V the .422 hole is drilled through to the milled slot. At *Sta.* 3-V a drill completes the hole to the shoulder. At *Sta.* 5-V the .332 dia. hole is drilled through from the larger hole, and at *Sta.* 7-V the small hole is tapped ⅜-24 thread.



for greater accuracy and higher production . . .

Now look at Section B-B, the .358 dia. *horizontal* hole. It has a break-through with the axis hole, and must be accurate. This work is accomplished at five stations. *Sta.* 1-H drills to the break-through at normal feed. *Sta.* 2-H drills *at fine feed* during the break-through. *Sta.* 3-H completes the drilling at normal feed. At *Stas.* 4-H and 5-H, pilot reamers rough- and finish-ream the hole to exact specifications.

The .218 dia. hole involves simple drill-thru and tap operations, at *Stas.* 6-H and 7-H.

Each Kingsbury machine is designed and built to achieve three prime objectives: 1) *accurate* interchangeable parts as specified, produced at the 2) highest practicable production rate, and 3) at a cost per part which will make the machine a wise investment. And each Kingsbury machine proves itself in a trial run before it is delivered.

Combined operations promote savings in equipment, and lower costs per part

When we designed the Kingsbury machine shown below, we estimated its production at 250 parts per hour gross. We were low: it's producing 308 parts per hour gross, at 2 4/10c per part.

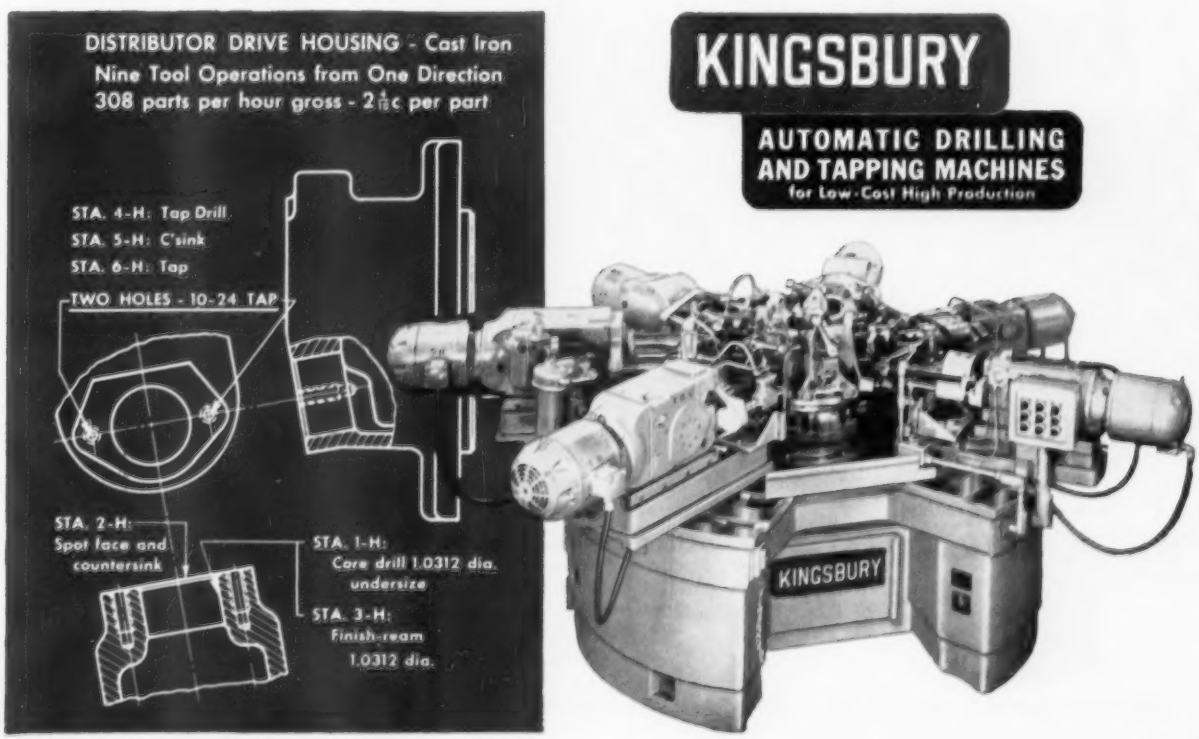
The machine has an 80-inch base on which are mounted six drilling and tapping units. A 24-inch index table with seven work-holding fixtures indexes through seven stations — one for loading and unloading.

All work is performed horizontally. The 1.0312 dia. hole is core-drilled undersize at *Sta.* 1-H, and finish-reamed 1.0312 at *Sta.* 3-H. *Sta.* 2-H spot-faces the joint face and forms countersink.

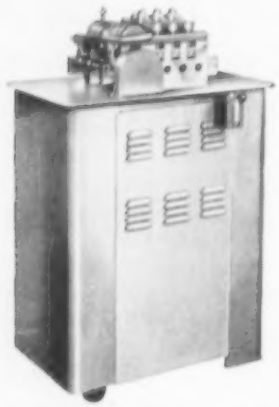
At *Stas.* 4, 5, 6, the Kingsbury units are equipped with auxiliary heads and drill, countersink and tap (10-24) the two small holes.

This Kingsbury is a good example of the savings in equipment and time which result when operations can be combined without risking uniformity. And, as is true with all Kingsburys, one of the big "secrets" of its success is the design of the work-holding fixtures. A part must be positioned in a matter of seconds, and held securely at each station, if the work is to be accurate. Therefore, the work-holding fixture is the very *heart* of a Kingsbury, and it's built with loving care! Perhaps that's one reason why Kingsburys perform so well!

Kingsbury Machine Tool Corp.
115 Laurel Street
Keene, N. H.

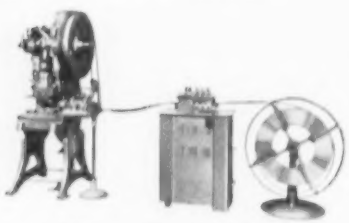

DISTRIBUTOR DRIVE HOUSING - Cast Iron
Nine Tool Operations from One Direction
308 parts per hour gross - 2 4/10c per part
STA. 4-H: Tap Drill
STA. 5-H: C'sink
STA. 6-H: Tap
TWO HOLES - 10-24 TAP
STA. 2-H: Spot face and countersink
STA. 1-H: Core drill 1.0312 dia. undersize
STA. 3-H: Finish-ream 1.0312 dia.
KINGSBURY
AUTOMATIC DRILLING AND TAPPING MACHINES
for Low-Cost High Production
KINGSBURY

FLEXIBILITY
in Stock Straightening



WITTEK
STOCK STRAIGHTENERS

Used in conjunction with a reel stand and automatic feed for punch presses, the Wittek Stock Straightener is a self-contained, motor-driven unit designed for maximum efficiency in the continuous straightening of coiled stock. Standard models handle stock with widths up to 12 inches. An infinitely variable speed drive permits any desired straightening speed so that the proper slack is maintained in the straightened strip between the unit and the press feed.



This typical Wittek automatic production feeding setup includes—Wittek roll feed mounted on the punch press, Wittek stock straightener, and Wittek self-centering reel stand.

Write for full particulars

WITTEK Manufacturing Co.

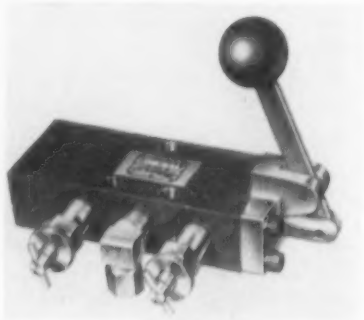
Production Feeding Equipment

4320 W. 24th Place • Chicago 23, Illinois

NEW SHOP EQUIPMENT

powered by a NEMA-type motor of 1½ to 7½ hp. Controls, manufactured by Allen Bradley, include forward, reverse, off, and jog switches, arranged in a watertight mounting. A 24-hr timer is available as optional equipment.

Lord Chemical Corp, Dept C, 2068 S Queen St, York, Penna



Exhaust Control Valve

Modernair Model 500 exhaust speed control valve screws into either or both exhaust ports of a 5-port, 4-way valve to provide speed control of air cylinder piston in one or both directions, or into exhaust port of a 3-way valve to regulate piston return speed on a single-acting cylinder.

Valve, precision machined from non-corrosive brass bar stock, is available in ¼, ⅜, and ½-in. NPT pipe thread sizes. Parts are permanently assembled; adjusting screw cannot be blown out. No tools are required for flow adjustment; needle valve can be adjusted and locked by hand.

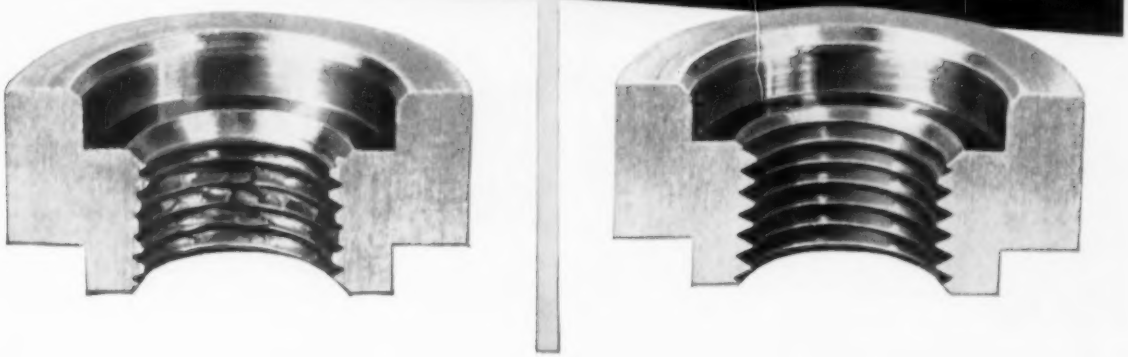
Modernair Corp, 400 Preda St, San Leandro, Calif

Flexible-tube fittings added to Flex-O-Tube line include push-on fitting for low-pressure use and a two-bolt clamp for high-pressure applications. Push-on fitting is brass, comes in ¼, ⅜, and ½-in. size, and is designed for use with a P54 rubber-covered hose up to pressures of 250 psi. Fitting is made in six types, and is assembled merely by pushing hose over twin ferrules on the fitting stem. Second fitting, called Dynalok, is clamp fitting made of heavy malleable iron and is secured by two large heat-treated bolts. Engineered for use on heavy-duty equipment, clamp fitting is made in eight sizes to accommodate hose from ¼ to 2 in. in diameter.

Flex-O-Tube Div, Meridan Corp, 2525 Jim Daly Rd, Inkster, Mich

V-8 CLUTCH HOUSINGS are machined on special unit which completes 120 parts per hr, handling two models on the same machine. Machine drills, chamfers, rough- and finish-bores starter hole; reams two dowel holes; spot-faces four inside bosses; and taps five holes in the housing. Featuring six work stations, power clamping, elevating-type fixtures, and special chip-disposal system, unit is composed of standard components, including Hydro 30 (vertical 60-hp hydraulic feed unit), Hydro 5 (vertical 7½-hp hydraulic feed unit), and 60-in. hydraulic index table—*Michigan Drill Head Co, Box 4643, Detroit 34, Mich*

Why BALANCED CHEMICAL ACTIVITY in a cutting oil?



Left. Cupro-nickel bushing, cut in half to show internal threads, produced with a competitive straight oil.

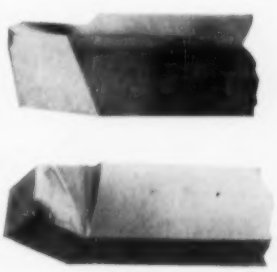
Right. Same type cupro-nickel bushing produced with Stuart's Thredkut X-18—providing controlled chemical activity.

The touch of a cutting oil with *balanced* chemical activity is easily recognized. It's the exceptionally smooth, satiny finish on part after part, even from soft, tough, stringy material . . . and increased tool life.

Stuart's Balanced Cutting Oils have controlled active sulphur and chlorine held in true chemical combination. Each oil is balanced to meet a specific range of job requirements from tapping, threading, gear shaping and gear hobbing to general purpose automatic screw machine work. Stuart oils with high sulphur activity are processed for the more difficult machining of soft, tough, stringy materials such as low carbon and stainless steels, monel metal and jet engine alloys. Oils with lower sulphur activity are designed for high speed machining of free-cutting materials such as B1112, B1113, leaded screw stocks, brass and aluminum alloys.

The "active" sulphur content of Stuart's Balanced Cutting Oils, as opposed to "lazy" sulphur, provides the anti-weld qualities that are so necessary to obtain smooth finishes. The active chlorine and fatty oil content provides the improved lubricity and temperature control to assure the best possible results in production.

Have "the Man in the Barrel", your Stuart Representative, assist you in selecting the right cutting oil for your job. Write for Stuart's Cutting and Grinding Fluid Selector and Dilut-O-Graph Folder, too. It's a quick guide to starting recommendations on any job.



Top: Abnormal front clearance wear of cutting tool caused by excessive sulphur activity of cutting fluid.

Bottom: Cratering of cutting tool caused by insufficient sulphur activity.

D. A. STUART OIL CO., LTD., 2729 S. Troy St., Chicago 23, Ill.

More than a "Coolant" is Needed

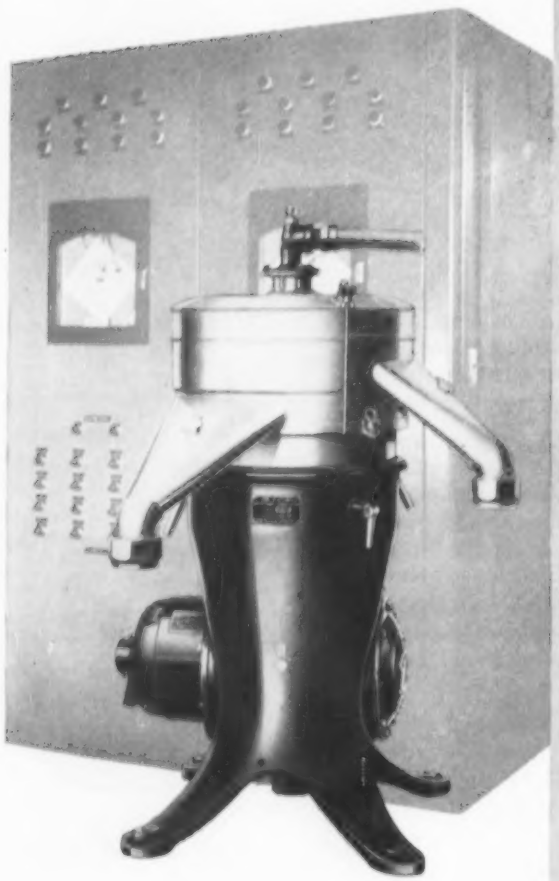
Stuart Oils

Time Tested Cutting Fluids and Lubricants

Plants in: Chicago, Detroit, Cleveland, Hartford, and Toronto, Ontario.

Branch Warehouses and Representatives in principal metal working centers in the United States, Canada and Europe.

AUTOMATION imposes new high standards on cutting oils!...



And DE LAVAL keeps your oil up to those standards!

With automation . . . it's more important than ever to keep cutting oil free of grit and metallic particles.

Because with automation, the greatly increased cost of down-time for tool replacement makes it vital to minimize replacement frequency.

De Laval Centrifugal Cutting Oil Purifiers increase tool life tremendously . . . prevent excessive wear . . . give you longer machine runs . . . cut costs!

Whether your plant is converted to automation or just considering it . . . De Laval Cutting Oil Purifiers can make the big difference in your profit picture!

DE LAVAL
Purifiers and Clarifiers for Factory Oils

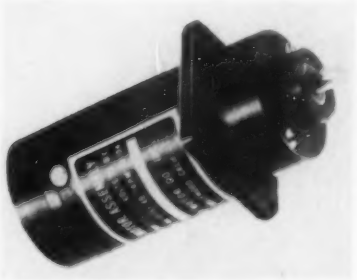
THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 201 E. Millbrae Ave., Millbrae, Calif.

Spiral Flute End Mill

Mill, said to combine advantages of a solid carbide cutter with the economy of a carbide-tipped tool, has no bent or twisted carbide; it incorporates a sandwich brazed, solid carbide insert correctly ground to precise tolerances. Special design is said to increase rigidity to assure greater accuracy, eliminate brazing strain and heat check to afford twice production per tool. True spiral design reportedly reduces cutting pressures to promote cooler, smoother operation with better finishes to closer tolerances.

Unit is available in two series, for steel and for non-ferrous metals, in standard sizes from ½ to 1 in.

Nelco Tool Co, Manchester, Conn



PLANETARY GEARED MOTOR with brake, Model 1700-1, for continuous duty, operates on 25-29v dc normal; current, 400 amp; reversible rotation; output, 1 lb-in.—*El Ray Motor Co, 11747 Vose St, North Hollywood, Calif*

Drum-handling clamp of 2000-lb capacity rotates through a 90° arc to permit picking up drums in vertical position and stacking them horizontally. Clamp arms are rubber coated. One arm is articulating and shaped

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FOR SPECIAL
MILLING CUTTERS

ANY SIZE, ANY SHAPE
to meet your individual needs

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for long wear life and tooling economy

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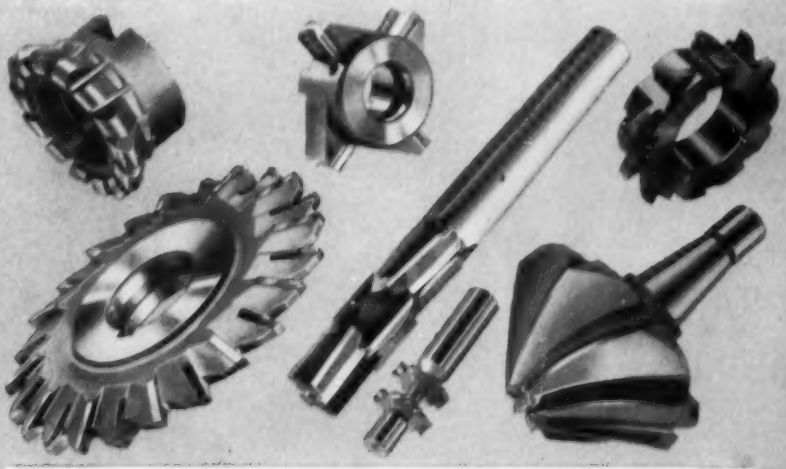
correct for fast, free cutting



SEND FOR COMPLETE INFORMATION. Pratt & Whitney Cutting Tool Engineers can help solve your special tooling problems. Write now on your Company letterhead outlining your needs.

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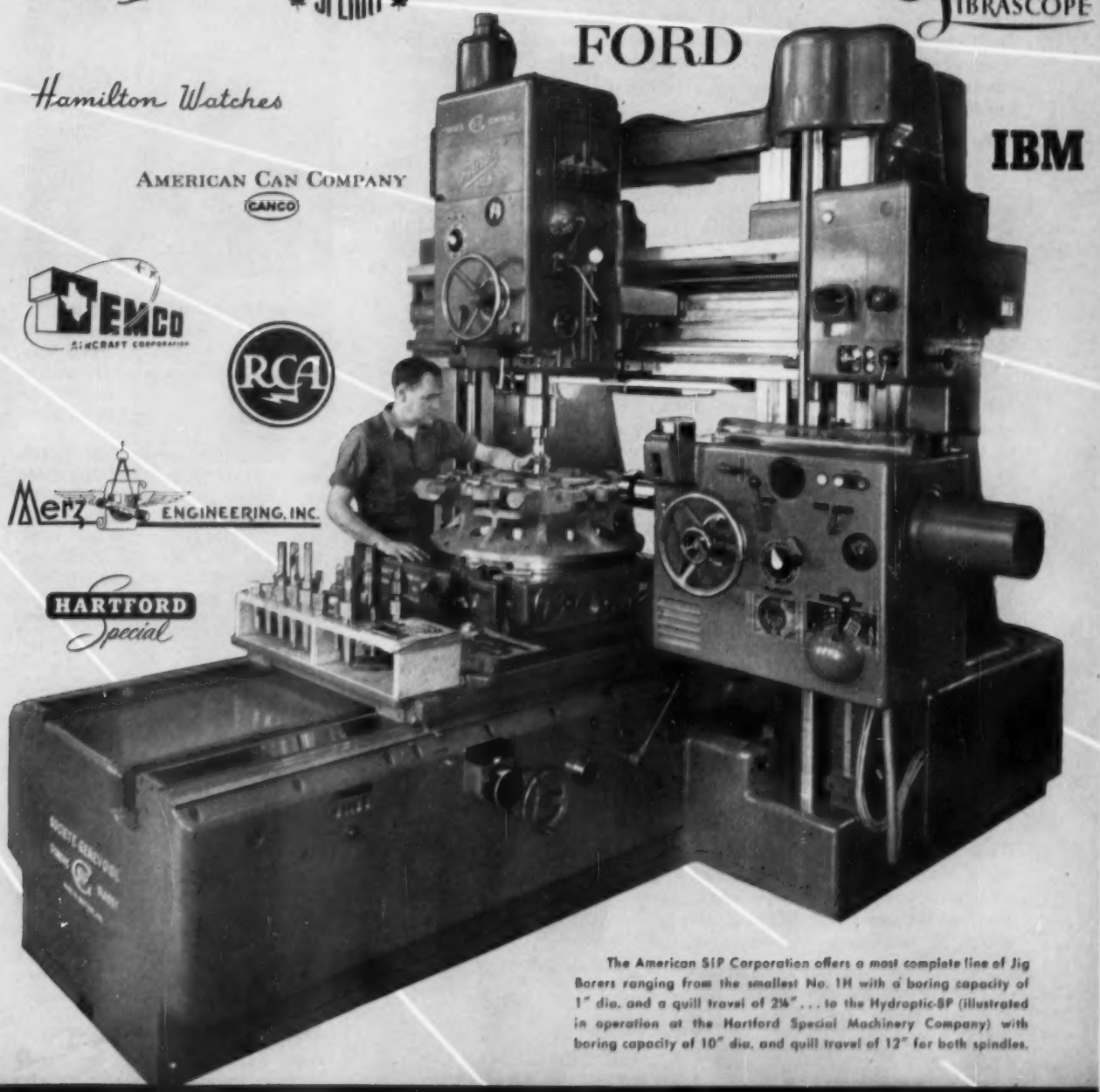
THE AMERICAN SIP CORPORATION *High Precision Machine Tools*



The American SIP Corporation offers a most complete line of Jig Borers ranging from the smallest No. 1H with a boring capacity of 1" dia. and a quill travel of 2½"... to the Hydroptic-8P (illustrated in operation at the Hartford Special Machinery Company) with boring capacity of 10" dia. and quill travel of 12" for both spindles.

and Measuring Equipment 100 EAST 42nd STREET, NEW YORK 17, N. Y.

WW Aluminum Bronze—what it is and what it can do for you

Aluminum bronzes comprise a group of copper base alloys containing up to 15% aluminum. Generally, each of these alloys also contains a lesser amount of one or more other elements such as iron, nickel, manganese or silicon.

By changes of the chemical composition, by variations in the alloying techniques, by special heat treatment, or by combinations of these methods, the properties are controlled, and can be made to range from those of moderately strong alloys with excellent ductility, to those of extreme hardness and high compressive strength for applications where ductility is not a requisite.

Structurally, there are two types of aluminum bronzes—single phase alloys and two phase or duplex alloys. Duplex alloys contain more than 8.5% aluminum. The single phase alloys are readily cold or hot worked and are strengthened only by cold- or hot-working. The duplex aluminum bronzes can be cold-worked to a limited extent, but can be readily hot-worked, hardened and tempered.

What it can do for you

All of the WW Aluminum Bronze alloys are characterized by their excellent resistance to wear and low coefficient of friction in contact with dissimilar metals. They have good resistance to corrosion and to scaling at high temperatures. In addition, they are anti-magnetic and non-sparking; they have vibration damping properties and specific gravities lower than those of other copper alloys. In fact, the strength to weight ratio of aluminum bronze is comparable to heat treated aluminum alloys.

These unique characteristics make aluminum bronze important to the product designer in the following typical applications:

Wear Resistance—bearings, bushings, machine tool parts, forming and drawing dies, wear plates, gears, cams, worm wheels, slides, guides, etc.

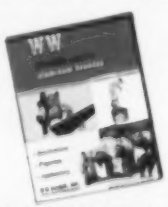
Corrosion Resistance—heat exchanger equipment, cylinder heads, pump parts, pickling equipment, autoclaves, valve sleeves, marine parts, etc.

Non-Magnetic—electrical parts, instrument housings, aircraft and marine parts, etc.

Non-Sparking—tools: hammers, sledges, saws, wrenches, crowbars, picks, shovels, etc.

WW Alloys maintains its own foundry and forging facilities for *premium quality* centrifugal, sand, permanent mold castings to your specifications. Parts can be furnished partly or finish machined, ready for use.

Write now for our 32-page bulletin "WW Aluminum Bronzes," containing a comprehensive description of the alloy group, engineering data and specifications for individual alloys, drawings, tables of machining recommendations.



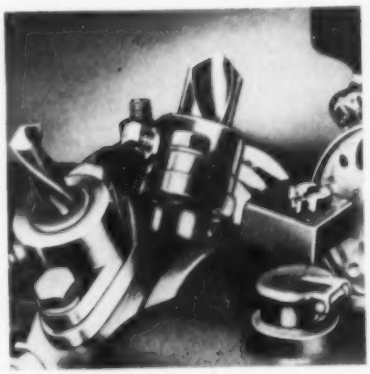
WW ALLOYS, INC.

11652 CLOVERDALE AVE.
DETROIT 4, MICHIGAN

Division of Fansteel Metallurgical Corporation

with two concavities which fit drum shape; other arm is flat surfaced and tapered slightly, so that upon release of clamping pressure drums will roll into position. Clamping range of the 42-in.-long arms is from 17⅜ to 71⅜ in.

Yale Materials Handling Div, Yale & Towne Mfg Co, 11,000 Roosevelt Blvd, Philadelphia 15, Penna



Screw Machine Drill Series

High-speed, straight-shank, short-length drills for use in screw machine drilling operations, are said to provide ease of penetration, efficient chip removal, and long life between re-sharpening.

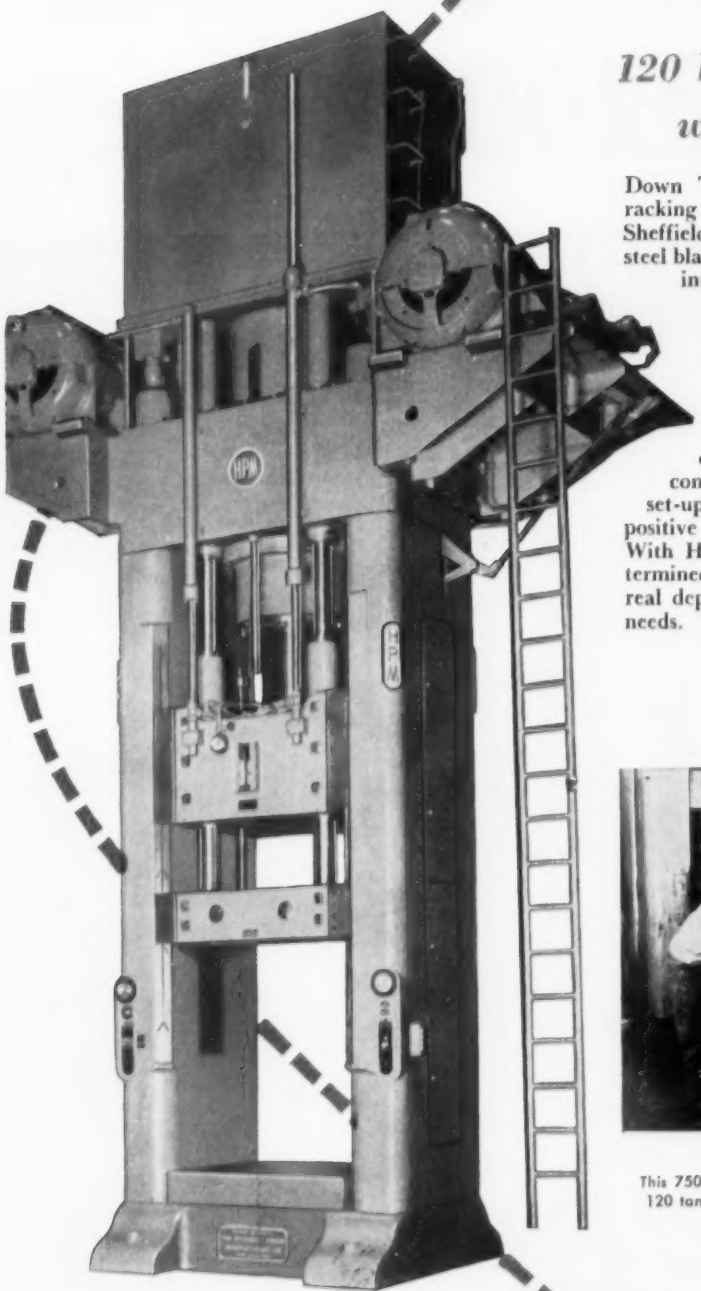
Manufacturer states that initial costs of drills are less, and that there is no expense involved in cutting off, re-pointing, and web thinning as when full length drills are used. Units are available in fractional, wire gage, and letter sizes in both RH and LH styles.

Whitman & Barnes, 40600 Plymouth Rd, Plymouth, Mich

Adjustable Electric Vibrator

Force of vibration can be varied without changing weights in this electric bin vibrator. Each end is equipped with two interleaving ec-

BIG THINGS WITH H-P-M PRESSES



120 Big Draws Every Hour with 750-Ton H-P-M

Down Texas way, this big 750-ton H-P-M is racking up impressive production figures for Sheffield Steel Corporation of Houston. The .210" steel blanks, 39" in diameter, are fed automatically into the press and drawn to a depth of 10". The finished tank heads are 30" in diameter; later welded to tank cylinders for gas storage use.

Here's why H-P-Ms really pay off for Sheffield . . . smooth fast drawing action without impact . . . fastraverse closed-circuit system for constant and controllable drawing speed . . . quicker die set-up . . . positive overload protection . . . positive blankholder pressure for entire draw. With H-P-Ms you have press reversal at predetermined pressure or position. Specify H-P-M for real dependability—for all of your metalworking needs. Write today for complete information.

This 750-Ton H-P-M with automatic feeding device turns out 120 tank heads an hour for the Sheffield Steel Corporation.

For one dependable source . . . for one responsibility . . . for all your metalworking needs . . . specify H-P-M.

METAL WORKING DIVISION

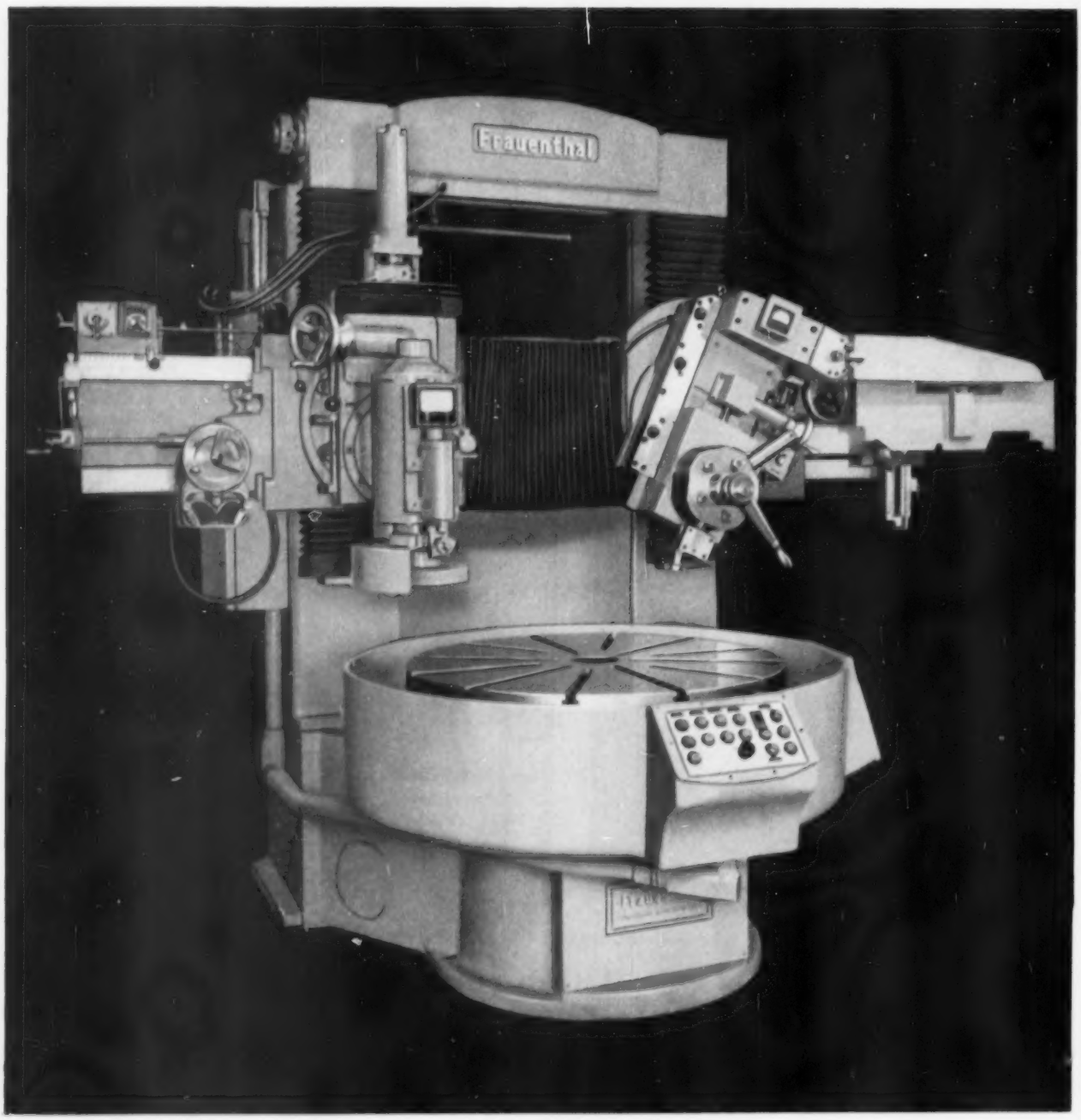
THE HYDRAULIC PRESS MFG. CO.

Mount Gilead, Ohio, U.S.A.

HPM

CAN YOU

to .000200" accuracy



turn, bore and grind in a single set-up?

The Frauenthal 3100 Series offers this precision and versatility with these cost-cutting features

1. Utmost versatility — Both grinding compound and turret slide can be swiveled to meet practically any angular requirement.

2. Super-precision performance — Only a Frauenthal grinds related surfaces to accuracies within .000200″, producing consistently uniform precision in concentricity, parallelism and roundness.

3. Horizontal table — Loads easier and faster than vertical face plates. Horizontal table also provides greater stability for large, heavy parts.

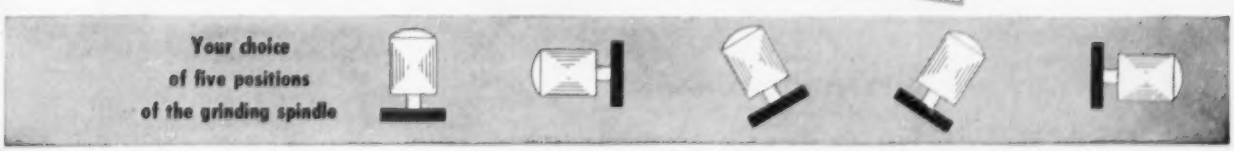
4. Simplified tooling — Horizontal table permits simpler fixtures, particularly for thin-section jet engine parts, plus economy of dual purpose tooling for turning and grinding.

5. Convenient controls — All operating controls are easily within the operator's reach for quick selection of feeds and speeds. Electrical interlocks are provided for utmost safety.

6. Contour turning — Hydraulic duplicator attachment (turning head) performs tracer controlled turning operations most accurately and performs repetitive operations at lower cost.

May we help you?

If you'd like further information on how the 3100 Series precision turning and grinding machine can give you production and/or tool room advantages — our engineers are at your service. Write for informative bulletin No. 301.



Frauenthal Division · KAYDON ENGINEERING CORP. · Muskegon, Michigan

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is valuable too!

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When it comes to checking external threads, a P&W Tri-Roll Thread Comparator can save valuable time and increase your profit margin by reducing inspection costs. But fast, easy operation is only part of the story. *Only* Tri-Roll gives you a complete, visual analysis of lead, angle and pitch in one operation . . . *plus* a direct reading of out-of-roundness by rotating the work. *Only* Tri-Roll offers an alternate, critical check of pitch diameter by using two-rib rolls. And ONLY PRATT & WHITNEY can offer you Tri-Roll Thread Comparators with all their advantages of dependability and economy.

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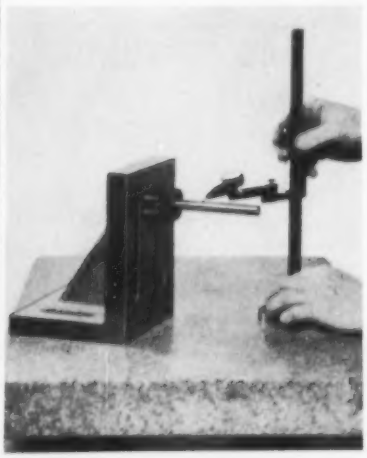
MACHINE TOOLS • GAGES • CUTTING TOOLS

NEW SHOP EQUIPMENT

centric weights held together with a bolt. They may be closed into a semicircle, giving maximum force, or opened up into a three-quarter circle for minimum vibration.

RC-10 has six settings, ranging from 140 to 550 lb of impact; RC-30 has seven settings, 385 to 1110 lb; RC-50 has a 750 to 2250-lb range with seven settings. Units are said to be completely silent.

Cleveland Vibrator Co, 2828 Clinton Ave, Cleveland 13, Ohio



CHECKING DEVICE, called Magnacheck, assures fast, positive inspection of angle plates, angle bars, dies, and tools. Angle of deviation from true horizontal or vertical can be quickly proved on most movable or mounted fixtures. Permanent magnetic base eliminates necessity for clamping— *Magna-Lock, Inc, 256 Maple St, Big Rapids, Mich*

Nitriding process, designated Supercase, for use on martensitic, ferritic, and austenitic stainless steels, is especially designed for parts where extremely hard, wear-resistant surface with maximum corrosion resistance is needed. Supercase may be removed after parts have been finished, parts re-worked, then re-nitrided.

Standard Steel Treating Co, 3467 Lovett Ave, Detroit 10, Mich

Aluminum-foil nameplate tradenamed Therma-Cal is anodized and etched strip intended for use on curved, painted, or uneven surfaces. Plate has special sealing material which produces a permanent bond without prior water soaking. To apply, user peels off paper liner protecting adhesive, places plate on product, and applies heat with hand

LEADERS IN INDUSTRIAL SAFETY: JOHNSON MOTORS

Industrial safety is as vital to Johnson Motors as the production of fine outboard motors. The fire hazard that die-casting equipment ordinarily creates has been controlled at Johnson through the use of fire-resistant Pydraul hydraulic fluid.

FIRE-RESISTANT PYDRAUL F-9
CHANGES FIRE ZONES TO SAFETY ZONES

275 million hours of actual in-use operation—without a single hydraulic fire—*proves* the safety and dependability of fire-resistant Pydraul hydraulic fluid.

But Pydraul gives you more than safety. You can be sure of long equipment life with low maintenance . . . because Pydraul lubricates like a premium petroleum oil. You'll save money on fluid consumption, too! Pydraul is reclaimable—you can return spillage to the system, use it again and again.

Make a quick check of your hydraulic equipment . . . calculate your fire risk if it's close to hot metal, electrical contacts, open flame or other heat sources. Then talk to a Monsanto representative. He will show you how easy it is to convert to Pydraul . . . giving you a future of positive safety from hydraulic fires . . . at low cost per year.

PYDRAUL MEANS:

Fire Resistance
Excellent Lubricity
High Stability
No Corrosion
Re-use, Again and Again

Write now for new booklet, "PYDRAUL F-9." Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Dept. PYD-2, St. Louis, 1, Mo.

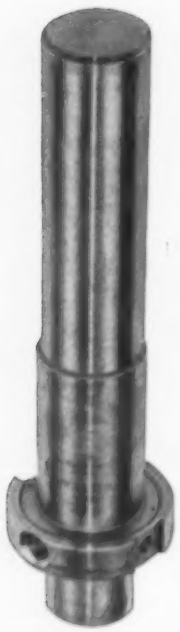
PYDRAUL F-9—First and Only Hydraulic Fluid Listed by Underwriters' Lab.

On May 31, 1955, Pydraul F-9 became the first fire-resistant hydraulic fluid listed by Underwriters' Laboratories. From the Laboratories' Service Card: "The fire hazard of (PYDRAUL) is rated 2 to 3 in accordance with Underwriters' Laboratories, Inc.'s Standard of Classification in which Ether rates 100, Gasoline rates 90-100, Alcohol (ethyl) rates 60-70, Kerosene (100° F. flash) rates 30-40, and Paraffin oil rates 10-20." See Underwriters' Laboratories, Inc.'s guide No. 540 18, File MH6049.

PYDRAUL Reg. U. S. Pat. Off.

MONSANTO

WHERE CREATIVE CHEMISTRY WORKS WONDERS FOR YOU



You may not be

Every one of your machine tools is—in truth —a coin-operated machine. Before anything comes out, you have to put in "coin," even though you don't use nickels.

But it might be better if you did! For then you could spot the "one-arm bandits" before their take is revealed (or simply neglected) on your balance sheets or P&L statements.

You could go *right* to the best opportunities for making high-return investments. You could replace the lemons with jackpots.

Ask your production people for their recommendations and when they specify Avey, you can be sure of the results.

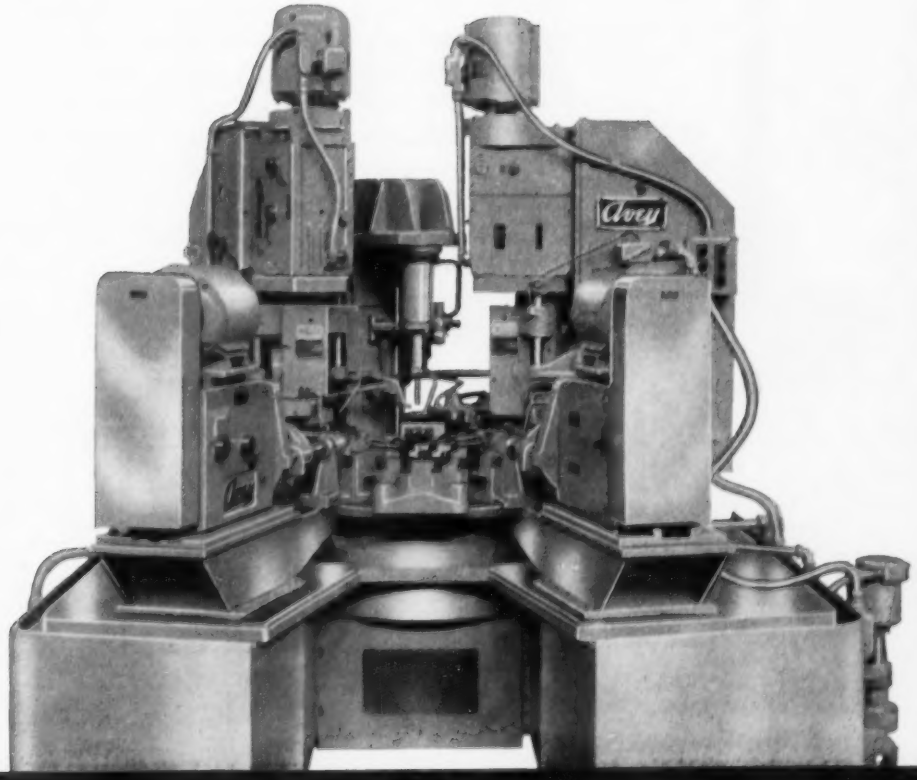
▸ **production data:** This 6-station Avey indexing machine performed drilling, tapping, milling, and broaching operations. Fixtures arranged to handle two different parts. Milling and broaching done in one pass, with cycle time of 8 seconds. Rate: 380 parts/hr. at 100% efficiency.

THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

drilling, tapping, production machines

in Las Vegas . . .

Avey



DRILL PRECISION HOLES

Whether you drill deep or shallow, vertical or horizontal . . . your drill press or lathe will give you *in one pass*, a true-round, straight hole with location and concentricity . . . AND YOU'LL SAVE MONEY!

HERE'S HOW: —

Use the accepted precision Gun Drill method

- Gun Drills eliminate boring, honing and reaming.
- Gun Drills operate at higher RPM, lower feeds giving you greater tool life, better wall finish.
- Gun Drills permit the use of multiple drilling and quick-loading fixtures . . . even automation.

Use SEALOL'S *easy-to-install* FLUIDRILL ADAPTER

- Fluidrill Adapters transfer coolants at high rotational speeds to 10,000 RPM . . . at pressures to 1000 psi.
- Fluidrill Adapters eliminate hot drilling and slow chip removal problems.
- Fluidrill Adapters improve quality of holes, give you fewer rejects and greater output.

Look at these savings from case histories on file:

- "Time of production reduced 500%"
- "Tolerance held to less than .0005 in."
- "Finishes held to 8 - 10 RMS"
- "Operations reduced 4 to 1"

FOR IMPROVED DRILLING PERFORMANCE in your shop, find out more about **PRECISION GUN DRILLING** with Sealol's **FLUIDRILL ADAPTER** today.

SEALOL

MAIL THIS COUPON TODAY

DEPT. G, WARWICK INDUSTRIAL PARK, PROVIDENCE 5, R. I.

Please send me Bulletin information on precision gun drilling with Sealol's FLUIDRILL ADAPTERS.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

electric iron for 6 seconds. Plates will withstand temperatures to 500 F.

North Shore Nameplate, Inc, 214 Northern Blvd, Bayside, LI, NY

Belt grease developed as a polishing aid for abrasive-belt operation on both ferrous and non-ferrous metals is available in paper tubes, size 2½ x 8½ in. Grease maintains a film on the abrasive surface, preventing metal particles from loading up and dulling abrasive grain on the belt. Grease is reported to be non-clogging, and to improve fire protection by eliminating need for inflammables to clean or lubricate belt after grease is used.

Kocour Co, 4800 S St Louis Ave, Chicago 32, Ill

Flux pots in Helmco-Lacy line, designed for warming and controlling brazing and soldering flux, are made in two sizes, holding five and slightly over ten lb of flux. Exteriors are of satin-finish aluminum; vitreous enamel bowls prevent contamination of flux. Heating elements are insulated, and a dial thermostat allows temperature-setting adjustments. 5-lb unit is 11 in. high and has diameter of 9 in. 10-lb unit has 11-in. diameter and is 12 in. high. Both pots operate on 110-120v ac.

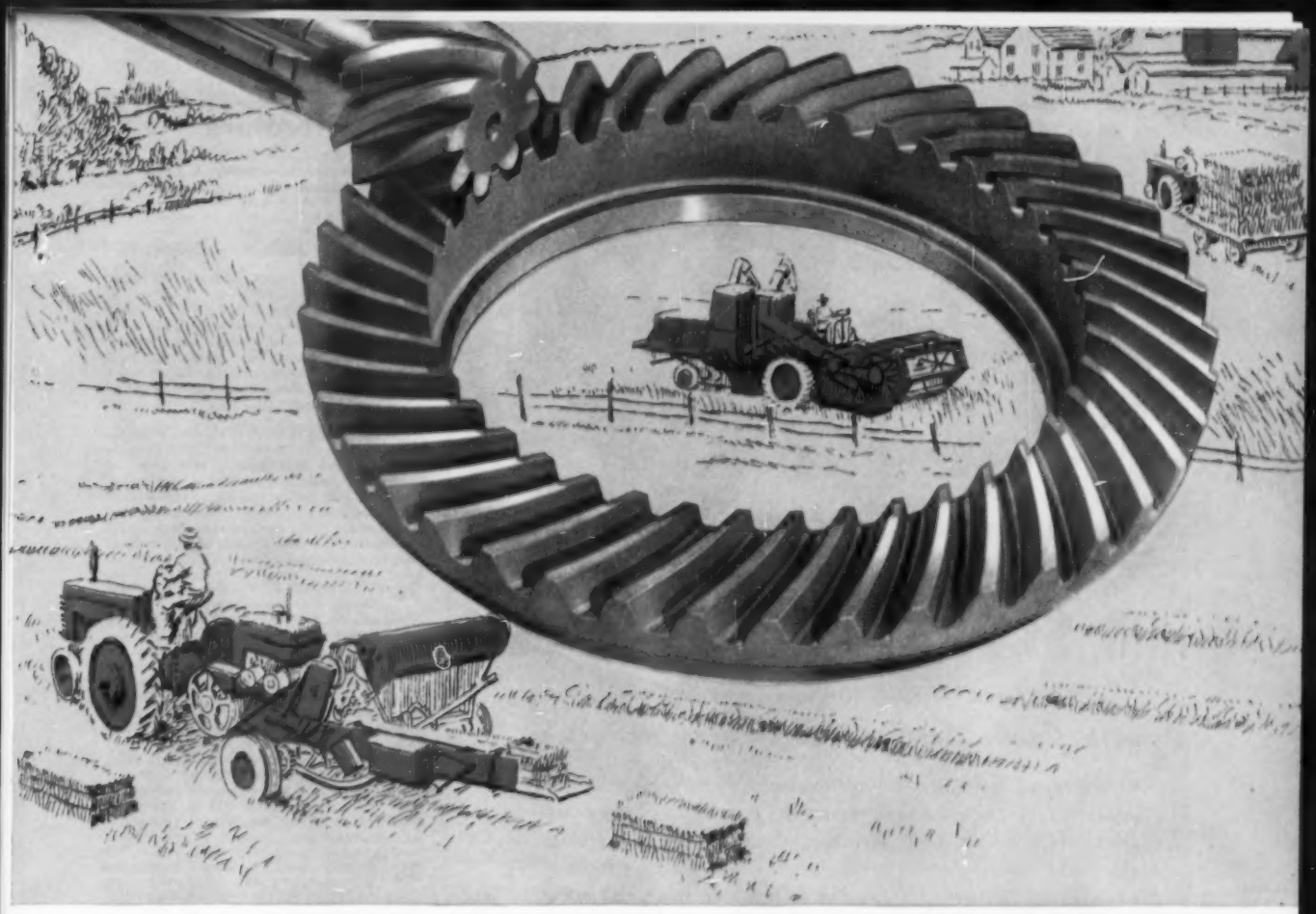
Helmco, Inc, 7400 W Lawrence Ave, Chicago 31, Ill

Plastic inch-millimeter plus-minus chart consists of a circle of seven sets of figures, five of which are on a master chart and two on an over-riding disk. Four inner circles enable user to figure from the inch system into millimeters. Three outer circles are used to make calculations from the metric to the inch system. Over-all dimensions are 4⅞ by 3⅜ in. Chart is available in small lots or in quantities of 100,000 or more.

Charles F Herbstreith Co, Nutley, NJ

Chamfering tools using slug-type indexable inserts are available in 20 sizes and styles of RH and LH 30° and 45° angles. Designated as semi-standards, tools incorporate low-cost replaceable parts similar to those used on company's other Multicut holders. Models SDR, SDL, SER, and SEL use square inserts, so that eight cutting edges are provided before any insert grinding is required. Maker states that tools are also suitable for turning operations.

Wesson Co, 1200 Woodward Heights Blvd, Ferndale 20, Mich



AGRICULTURE–geared to modern production standards

Unlike industrial machinery, farm equipment is exposed to everything that nature can throw at it. Soil is the element in which farm machines work. They're exposed to every fury in the book — heat, cold, snow, ice, dust. They stand idle much of the time, then go to work at an instant's notice, performing perfectly for hundreds of gruelling hours. And they must be built against breakdown that interferes with the critical time schedules of much farm work.

That gears of our manufacture are specified for so many different kinds and makes of farm machinery is proof of their rugged ability to perform reliably under the most rigorous circumstances. Their daily work on America's farms proves their fitness for service in your products or equipment.

Why not write today for further information?

DOUBLE DIAMOND GEARS

FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS
GEAR-MAKERS TO LEADING MANUFACTURERS

Automotive Gear Works, inc.

ESTABLISHED IN 1914 — RICHMOND, INDIANA

SUBSIDIARY OF EATON MANUFACTURING COMPANY

McCROSKY

COST CUTTING TOOLS

3/8" - 7/16" - 1/2" and 5/8"

THIN SLOTTING CUTTERS

4" — 5" — 6" — 8" — 10" and 12" in diameter

with Jack-Lock® Blade Locking Wedges

• Designed specially for milling thin slots accurately and efficiently. Jack-Lock wedges extend the full width of the body. Consequently, locking pressure is applied parallel to the sides of the body, assuring true running at all times. Cutting faces of the blades are milled and ground to provide the axial rakes required. Easily converted to a half-side mill by simply inserting blades all of one hand. Extra large hubs provide added ruggedness and rigidity. Easily mounted on a grinding arbor for resharpening. Unsurpassed performance. Write for a bulletin today!

WRITE FOR THE McCROSKY BULLETINS
. . . Send the coupon today!

McCROSKY TOOL CORPORATION
1351 Main Street
Meadville, Penna.

COST CUTTING TOOLS

Gentlemen:

Please send Bulletins describing the tools checked below.

- ☐ *Jack-Lock®* MILLING CUTTERS
- ☐ *Block-Type* BORING BARS
- ☐ *Super® Adjustable* REAMERS
- ☐ *Turret* TOOL POSTS
- ☐ *Wizard®* QUICK-CHANGE CHUCKS
- ☐ *Specially Engineered* MULTIPLE PRODUCTION TOOLS

Name_____ Title_____

Company_____

Address_____

Free Literature

To order any of these bulletins, please use cards at start of this section—page 176c.

MACHINES AND ATTACHMENTS

34 SINGLE CRANK STRAIGHT SIDE PRESSES — *Niagara Machine & Tool Works, Buffalo 11, N.Y.* 4-page bulletin 64 supplement describes units with enclosed construction, triple box section design, great shut height and long slide adjustment, electro-pneumatic clutch control. Models available from 100 to 400-ton capacities.

35 OSCILLATING TOOL GRINDER—*Wesson Co, Detroit 20, Mich.* 6-page bulletin gives illustrated information on Poweramic unit for off-hand grinding of standard and special single point carbide tools. Oscillating wheel moves through a true arc at 150 spm, eliminates manual lateral tool movement. Features described, specifications listed.

36 TRANSFER PRESSES—*Durant Tool Supply Co, Providence, RI.* Circular illustrates and describes 5 and 10-ton models with 2 or 3 plungers; strokes per minute are 75-150 and 75-125.

37 GEAR SHAVING MACHINE—*National Broach & Machine Co, Detroit 13, Mich.* 4-page catalog S-55-11 presents illustrated data on Red Ring Model GCP-24-in. unit that will straight or crown-shave external spur and helical gears from 3 to 24-in. PD in the 2 to 16 diametral pitch range, and internal spur and helical gears from 6 to 24-in. PD in the same tooth size range. Operating principles, specifications included.

38 PRESS BRAKE—*Dreis & Krump Manufacturing Co, Chicago 36, Ill.* 4-page bulletin 131-56 illustrates and describes design and construction features of Model 131. Complete specifications of the 11-ton capacity unit listed.

39 GRINDING IDEAS—*Landis Tool Co, Waynesboro, Penna.* 8-page bulletin contains illustrated information on how to centerless grind universal joint spiders; integrated production line for automatic grinding of crankshafts; economies of multiple wheel grinding; sine bar universal roll grinder. Includes chart on common grinding troubles, and how to correct them.

40 BETTS CAR WHEEL BORERS—*Consolidated Machine Tool Co, Rochester, NY.* 19-page bulletin 6107 illustrates and describes heavy-duty unit. Design features covered; operating principles outlined; standard and optional equipment listed; minimum dia of wheel that can be bored and faced is 19 in.; max dia, 48 in.; table dia, 53 in.

TOOLS AND ACCESSORIES

41 MEASURING EQUIPMENT — *General Electric Co, Schenectady 5, NY.* 40-page illustrated catalog GEC-1016 covers 80 devices ranging from simple thickness gages to mass spectrometer leak detector. Complete product data includes applications and sources of additional information.

42 HOLDING DEVICES — *Heinrich Tools, Inc, Racine, Wis.* 24-page catalog contains illustrations, descriptions, and dimensions of complete line including application of Grip-Master vises as jig and fixture bases. Covers vises and fixture locks, air clamps and air accessories.

43 HIGH SPEED UTILITY DRILLS—*Chicago-Latrobe, Chicago 16, Ill.* Folder contains information on drills especially designed and heat-treated for applications requiring a sturdier, shorter tool. Units, with shorter flute and over-all length reportedly have greater rigidity, withstand more stress and strain. Available in fractional, letter, and wire gage sizes.

Free Literature

44 ENGRAVING MACHINE — *W F Wolf Machinery Co, Los Angeles 58, Calif.* Literature describes and illustrates Scripta (French) Model SR-3D engraving and copying machine for work in three dimensions on molds and dies, hollow or in relief; adjustable for 23 ratios. Model SR-2D also covered, as well as Scripta Standard unit.

45 MICROMETER—*Link Aviation, Inc, Binghamton, NY.* 5-page illustrated bulletin describes Model 212 Fringecount measuring device, accurate to 0.000001 in.; measuring capacity, 0-2 in. Advantages, applications, technical principle, operational details, specifications covered.

46 INSERTS & BLANKS — *Carboloy Dept, General Electric Co, Detroit 32, Mich.* Bulletin GTO-102 details sizes and shapes of cemented oxide 0-30. Describes holders and accessories for applying cemented oxide blanks in machining. Bulletin GT-311 covers specifications for new high titanium, nickel binder grade 330 finishing carbide, including blanks for cylindrical and square boring tools. Prices and specifications included.

47 "ONE-SHOT" LUBRICATORS—*Bijur Lubricating Corp, Rochelle Park, NJ.* 4-page illustrated bulletin 3C describes semi-automatic units for servicing as many as 100 or more bearings on a machine requiring closely controlled but infrequent oiling. Three models covered; specifications, selection data, filtering features discussed.

48 ELECTRONIC POTENTIOMETER —*Bristol Co, Waterbury 20, Conn.* 64-page illustrated bulletin P1245A provides details on Dynamaster potentiometer and bridge instruments for recording and controlling. Models described with specifications and operational principles. Sensing elements and special attachments covered.

49 CARBIDE DRILLS—*Star Cutter Co, Farmington, Mich.* 4-page illustrated catalog gives data on Starbore drills for producing precision holes from the solid in cast iron, aluminum, bronze, and steel parts at feeds up to 60 ipm. Engineering and application information, specifications included.

50 SURFACE MEASUREMENT — *Micrometrical Manufacturing Co, Ann Arbor, Mich.* 8-page illustrated technical bulletin covers the important points of ASA Standard B46.1-1955 on surface roughness, waviness, and lay. Profilometer described; detailed listing of instrument characteristics for roughness measurement as specified by the Standard and provided by the Profilometer included.

51 PANTO ENGRAVERS—*H P Preis Engraving Machine Co, Hillside, NJ.* 7-page catalog illustrates and describes models for engraving on plastics, metal, and steel; electrical and acid etching; and diamond marking. Applications, dimensions, interchangeable heads and attachments covered.

PARTS AND MATERIALS

52 SELF-ALIGNING ROLLER BEARINGS—*Chain Belt Co, Milwaukee 1, Wis.* 72-page illustrated catalog 55 contains specification and data pages on all models of Shafer units with shaft sizes ranging from ¾ to 7 in. Design features described; revised engineering data, new load rating tables, specifications, parts lists included.

53 MOTORS & GENERATORS — *General Electric Co, Schenectady 5, NY.* 12-page bulletin GEA-6355 presents illustrated data on Kinamatic 1 – 150-hp dc motors built to new NEMA standards. Electrical and mechanical features, versatility of standard line, dimensions and ratings covered. 6-page bulletin GEA-6461 illustrates and describes Kinamatic generators, ¾ to 100 kw.

(Continued on page 239)

Big Barrel for better balance, easier reading. Genuine Chrome Clad finish.
Choice of Ratchet Cap, Friction Thimble or direct feel.
Choice of plain or carbide tipped spindle and anvil faces.
One-piece spindle with precision ground threads.
One-piece barrel and frame. Single boring provides exact spindle and anvil alignment.
Exclusive new cam lock optional.
Tapered Compression nut.
Choice of genuine Chrome Clad or slip-proof black cracale frame.
LUFKIN
WHY
LUFKIN
Micrometers give longer, more accurate service

1. TROUBLE-FREE DESIGN

Lufkin micrometers combine precision craftsmanship, the finest materials, and constant improvement in engineering. The taper design of the compression nut is just one example of the engineering thought put on every component.

2. EASY ADJUSTMENT

When anvil and spindle faces become worn, adjustment takes only a few minutes and reading line retains its original position.

3. WIDE CHOICE OF MODELS

Every personal preference, every job requirement can be met in the complete range of sizes and models in the Lufkin line.

BETTER MEASURE WITH LUFKIN

LUFKIN TAPES · RULES PRECISION TOOLS

THE LUFKIN RULE CO., Saginaw, Mich.
New York City Barrie, Ontario

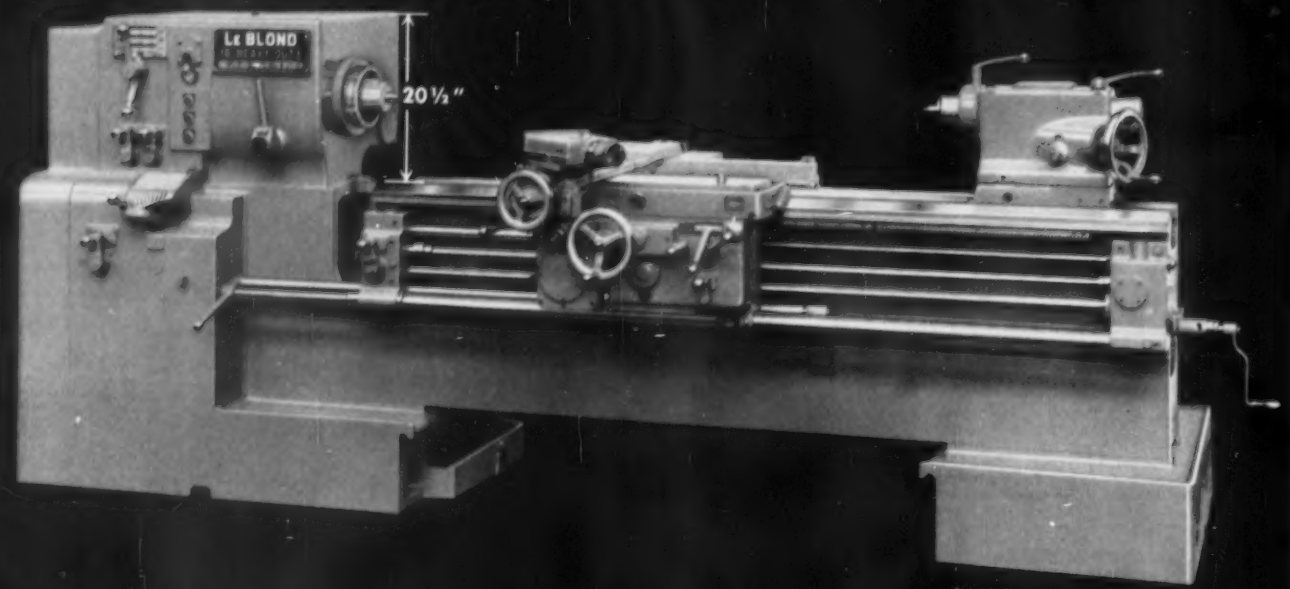
CONSULT YOUR INDUSTRIAL DISTRIBUTOR

- He can supply most items immediately from his stock.
- His knowledge of new tools and methods will help you operate at peak efficiency.

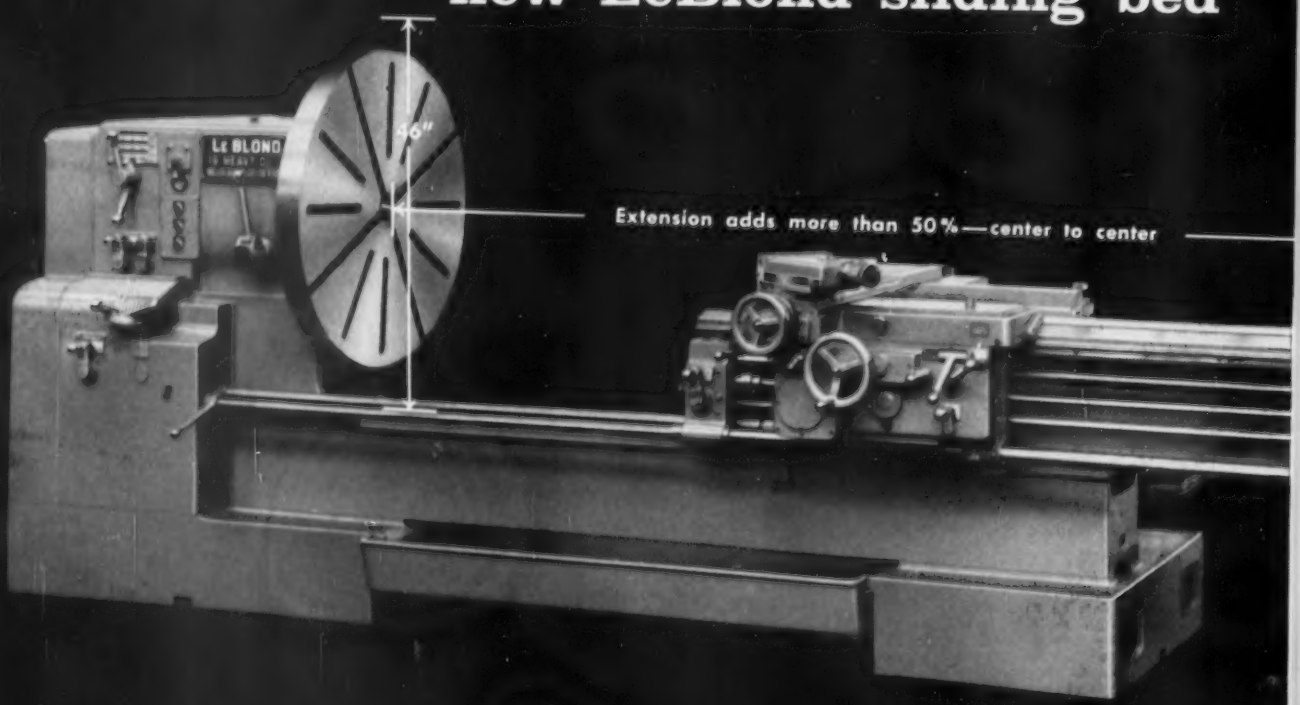
SAVE UNCERTAINTY

417

the lathe that gives versatile a new

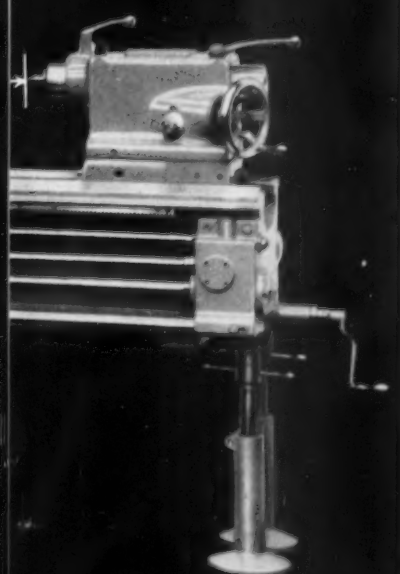


new LeBlond sliding bed



meaning!

gap lathe



Here's a lathe that is fundamentally different. It has a special bed that *slides* open to form a gap—gives you approximately *twice* the normal swing size. Sliding the bed also gives greater bed length, more than 50% greater distance between centers. And, with bed closed it functions as a regular engine lathe.

So, what we mean by a *versatile* lathe is one that actually changes shape to suit your odd-shaped parts. It handles all the usual work, plus a wide variety of large diameter jobs, extra long parts, and combinations of the two. "Swing size" as such is no longer a limitation. For example, here are some of the unusual capacities you can handle on the 16" LeBlond Sliding Bed Gap Lathe:

Face 38" diameters in one cut
Face 45" diameters in two cuts
Turn lengths more than 50% greater than normal center distance
With extension rest (optional): turn 27½" diameter, 13¼" length
With Full-Swing turning attachment (optional):
turn 45" diameter almost full length of gap

Other important features of the new LeBlond 16"/38" SBG Lathe include new spindle bearing design for high-speed turning, combination gear-belt drive headstock, 18 geared speeds, 9 timing belt-driven speeds from 8 to 2000 rpm, spur gear design, four-way rapid traverse, one-piece apron, totally enclosed quick change box, hardened and ground steel bedways, thrust-lock tailstock.

If you have a variety of parts to turn—particularly the unpredictable extremes you encounter in maintenance and job shop work—the LeBlond SBG may well be the answer. An economical answer, too! SBG's come in 4 sizes: 16"/38", 25"/50", 32"/60" Heavy Duties and the 17"/28" Regal. Like all LeBlonds they are built in every engineering detail to give you long dependable service.

Whatever your turning needs, there's a lathe in LeBlond's complete line to do the job. 76 different models to choose from. Call your LeBlond Distributor or write today.

. . . cut with confidence

LE BLOND
of Cincinnati

THE R. K. LEBLOND MACHINE TOOL COMPANY
CINCINNATI 8, OHIO

World's largest builder of a complete line of lathes for more than 69 years

the finest heavy duty lathes

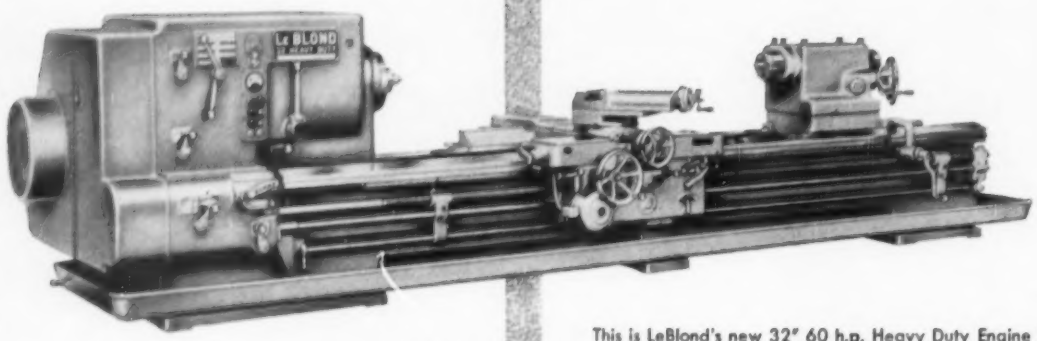
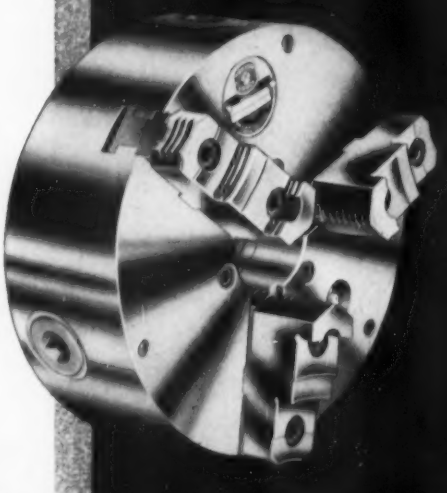


Photo courtesy LeBlond of Cincinnati

This is LeBlond's new 32" 60 h.p. Heavy Duty Engine Lathe. 36 speeds from 4.5 to 500 r.p.m. Adjustable acceleration to bring heavy workpiece up to speed safely. For complete details, write the R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio. Ask for Bulletin HD-165.

deserve the finest precision chucks



This is Horton's 3-Jaw Scroll Universal Chuck which for more than 100 years has been the companion to the world's finest lathes. Its lasting accuracy and precision contribute to the high production of any tool room or plant. For the complete story on this and Horton's complete line of high production chucks, see the Horton people in your area now.

HORTON
Since 1851
CHUCK

WINDSOR LOCKS, CONN.

Free Literature

54 PRECISION BEARINGS—*Industrial Tectonics, Inc, Ann Arbor, Mich.* 32-page illustrated catalog AFB-1 contains information on anti-friction bearings for special applications. Dimensons and load ratings given for single and double-row, deep-groove radial, and angular contact units. Includes general requirements for special designs, high and low temperatures, corrosion resistant and non-magnetic properties.

55 ZINC BASE DIE-CASTING ALLOYS—*Henning Bros & Smith, Brooklyn 37, NY.* 23-page reference booklet on Zamak alloys discusses dimensional stability, composition and limits in ingot form, mechanical requirements and properties, corrosion resistance.

56 GUIDE PINS, BUSHINGS, ACCESSORIES—*Lamina Dies & Tools, Inc, Oak Park, Mich.* 36-page catalog illustrates and describes 800-item line including new models, styles, sizes, and materials. Applications, dimensions, prices included.

57 SOLENOID VALVES — *Atkomatic Valve Co, Indianapolis, Ind.* Illustrated catalog 200 describes complete line of electrically operated two-way units in bronze and stainless for air, gas, steam, and liquid flow control. Dimensions, specifications, pressures, applications, coil and flow charts included.

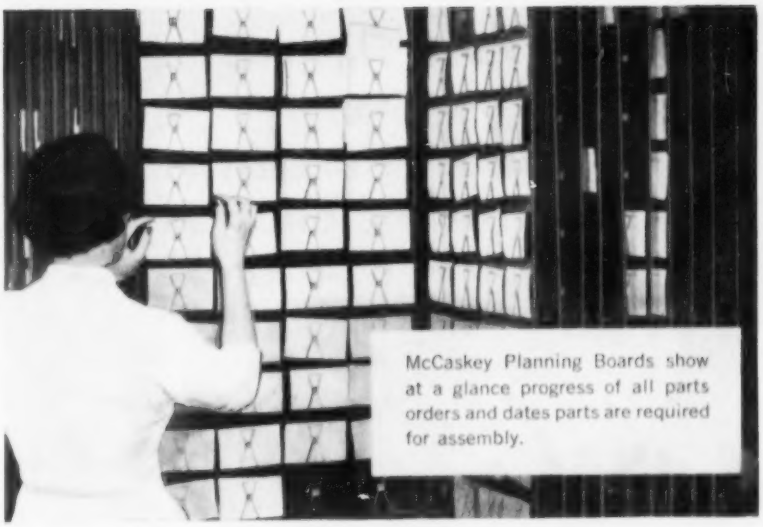
58 POWDER METALLURGY BIBLIOGRAPHY—*Harper Electric Furnace Corp, Buffalo 2, NY.* Publication refers to some 250 articles and papers printed in 50 US, English, and Canadian periodicals during 1954 and 1955. Lists 11 general powder metallurgy references and currently used textbooks.

ROUND TABLE *Discussion*

INSTALLMENT BLUES

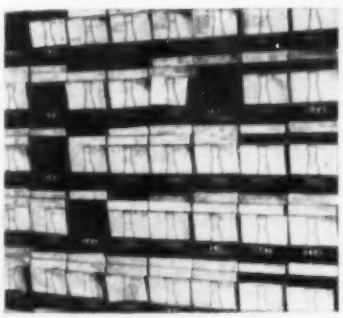
Is a raise in pay, or a promotion, the answer for the man who has gone over his head in debt? Won't he be just as liable to incur further debts with a little more money in his pocket?

Is it too much to expect a working man to live within his paycheck? This certainly poses a question which no one individual can answer. Each person who works or has money to spend is differently constituted; this is part of human nature. For some the over-extension of credit or buying beyond one's capacity to pay is a crime. To others it is a normal course of events. The last group look to the current trends in spending by our government, cities, and other large and powerful groups and say if *they* can enter into deficit spending why shouldn't I? What have I to lose? I'll have the use of the articles until I can't pay any more and then all I will lose is the article plus my payments. Sometimes this is a cheap way, and sometimes the worker gets caught and



McCaskey Scheduling and Production Control Pay Off For "Payloader"

Single form system saves costly man-hours and eliminates delays for The Frank G. Hough Co.



McCaskey machine loading and assignment boards schedule parts orders for machines and subassemblies.

McCaskey Planning Boards and Machine Control Boards—with *multiple copies of a single form*—prove effective for The Frank G. Hough Co. of Libertyville, Ill. during its present period of rapid expansion and increased employment.

Here are just a few of the ways McCaskey Scheduling and Production Control pay off for "Payloader"—how they can pay off for you:

(1.) Provide visible records of all jobs or parts orders and necessary completion dates.

(2.) Progress of parts orders is seen at a glance.

(3.) You can quickly review the status of every job in the plant and locate those that might upset schedule.

(4.) No delays because—Machine loading and scheduling of subassemblies proceed as specified by the production control department.

McCASKEY INDUSTRIAL CONTROLS
Production • Inventory • Tools • Maintenance • Costs
Division of
VICTOR ADDING MACHINE CO.
3900 N. ROCKWELL STREET • CHICAGO 18, ILLINOIS

VICTOR-McCASKEY LIMITED,
GALT, ONTARIO

Manufacturers of Business Machines Cash Registers, Business and Industrial Systems, Electronic Equipment, Electri-Cars.

Mail Coupon For Complete Information

Victor Adding Machine Co.
McCASKEY INDUSTRIAL DIVISION,
3900 North Rockwell Street
Chicago 18, Illinois

Please send me complete facts on: McCaskey Machine Loading and Production Control System.

Name _____

Position _____

Company _____

Address _____

AM-5-56

ONLY

GOSS and DeLEEUW AUTOMATIC CHUCKERS

offer the 1-2-3 feature

This NEW development—unsurpassed for speed, convenience of tooling and precise finish—involves no retooling problem even for short runs. It assures greater production at lower cost on all classes of work.

The unique "1-2-3" feature, exclusive with Goss & De Leeuw, provides the means for performing one to three right or left hand single or double threading operations simultaneously or in sequence, without changing set up.

Here's an ideal machine tool for small lot requirements because of quick, easy changeover. Any class of chuck work can be handled economically in any quantity.

The examples of work shown here are typical of the wider variety of parts being produced on these new machines.

SEND FOR detailed information on this new machine. Let us have samples of your work in order to give you time and cost estimates for handling it on the "1-2-3" Goss & De Leeuw.

GOSS & DeLEEUW

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

he must strive to pay off in good faith. It is this condition which forces him to seek new and higher-paying positions.

It is true that some people are easy marks when it comes to being sold something. If they have the money—fine. If they don't have the money, it is just as good. Little can be done to control this type of person. Many men and women fall into this class and from them we have some of our problems of over-extended credit.

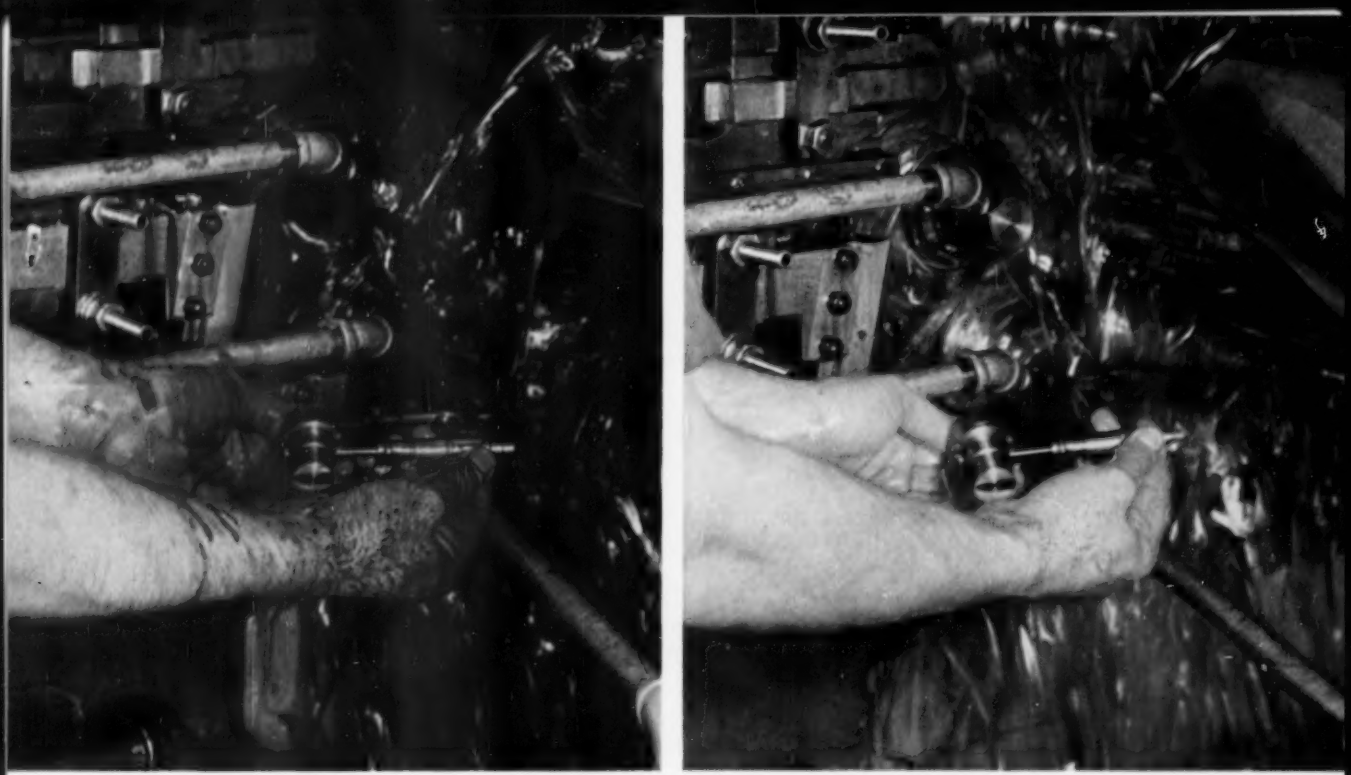
Let us look, however, at another group. This group wants to have things, and wants them placed on a pay-as-you-go basis. Nothing wrong with this. We pay our taxes this way. It is actually buying from current income things which it would be impossible to have in any other manner.

It is the way in which our present way of life has grown up. We can have the luxuries of life during our lifetime and not at old age only by paying as we earn.

Naturally any over-desire to keep up with the Jones's can place this group in the definite deficit-spending group. But on a whole, the major portion of our workers are good level-headed individuals who only bite off what they can pay for from pay-check to pay-check. Thus our industries are aided by this group. People buy more things, and pay for them over their lifetime, but it makes work and prosperity for many.

Not exactly a wrong attitude to buy on time, but it is wrong to overbuy. Those who want to save and then buy can still do so, but look around. These people do not have the latest things. Sure, they are probably satisfied with what they

"Yea, he punched in on time, but will he be able to stay awake so he can punch out on time?"



Black cutting oil (left) makes close control difficult. Operators dislike dirty operating conditions it creates. Close control is easier and workers are happier with transparent Sunicut cutting oil (right).

WHY USE A BLACK CUTTING OIL WHEN YOU DON'T NEED IT?

Sunicut oils give you better visibility without sacrificing machining efficiency.

When trying to maintain close control over machines producing precision parts, operators can be handicapped by "black-oil blindness". It is hard to see the tools, the workpiece, and the finishes. Checking close tolerances is difficult when the graduations on micrometers and gauges are obscured.

Worse still, as the operator sees it, are the dirty working conditions caused by dark oils. His clothes get saturated with hard-to-remove stains, and his hands are black from one end of the shift to the other.

Transparent Sunicut oils help keep your operators happy and will make close control easier ...and transparent Sunicut oils will do the job with no sacrifice in machining speed or finishes.

To get the full story on Sunicut oils, see your local Sun representative, or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-41.

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No two machine shops have exactly the same problems when it comes to selecting cutting oils...even when they're running the same job. And, until somebody comes up with the truly universal cutting oil, you can't afford to disregard the importance of oil selection. Here's how Sun can help you.

First, Sun makes a complete line of emulsifying and straight cutting and grinding oils. Second, your Sun representative, backed up by field engineers, has the necessary practical experience to recommend the oil that will give you both high machining efficiency and low over-all costs.

For the full story about Sun's cutting oils, see your Sun representative...or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-42.

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have, but we are speaking in terms of possessions and not desires.

Let's face it—we are in a time of pay-as-you-go thinking and under these times careful on-the-cuff buying is good for business. Our credit curbs will take care of the fellow who is a hog and wants to live up to and beyond the Jones's. Let the fellow who wants or needs more money look elsewhere for his job . . . if he is not worthy of promotion. He is a poor manager and has not anyone but himself to blame if he is in a fix financially and needs additional money to pay off his installments. He is not the man you want to keep in your company.

Charles D Townsend
West Hartford, Conn

•

AUTOMATION BLUES

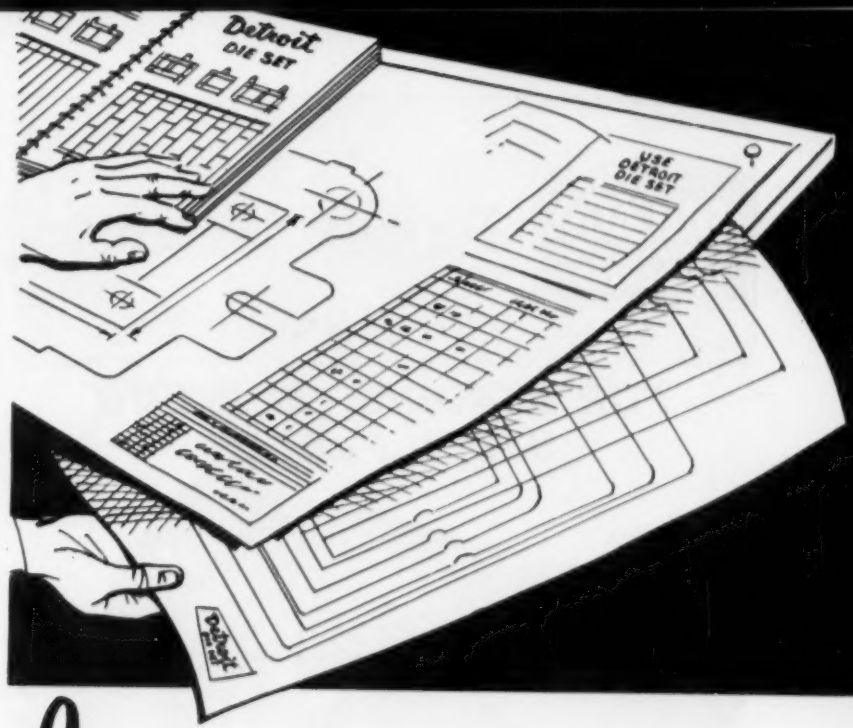
Is automation actually a threat to a worker's job security? Should it be looked on as a system which will eventually replace today's worker, or as a technique that will multiply jobs in other fields?

AUTOMATION is a new name for an age-old idea. It has been under development for centuries. It is evolution, not revolution.

The fear and opposition to automation results from a lack of understanding of what it really is. Twenty-five to fifty years ago there were similar fears widely prevalent in the United States; these were fears of the machines of production. Today, the same old blind, unreasoning fear of machines is reappearing among us; but we are being frightened, not by the advance of technology itself—but by this strange, new word—automation.

It seems that there is a natural, inborn fear of things that are new and different. Recently the Public Opinion Index took a poll among more than a thousand factory workers, and asked them two questions, —first, did they favor the use of more new and "improved" machines? The results showed that they favored the improved machines by three to one. Then they were asked how they felt about automation. They were opposed by over three to two. Yet the two things are really identical. There is nothing new about automation. It is as old as the industrial revolution.

One of the early proponents of automation lost his life to it without ever hearing the word. Nearly three centuries ago an inventor in Danzig built a loom which could weave six webs at once. The workers feared for their jobs and smashed the machine and drowned the inventor. At the



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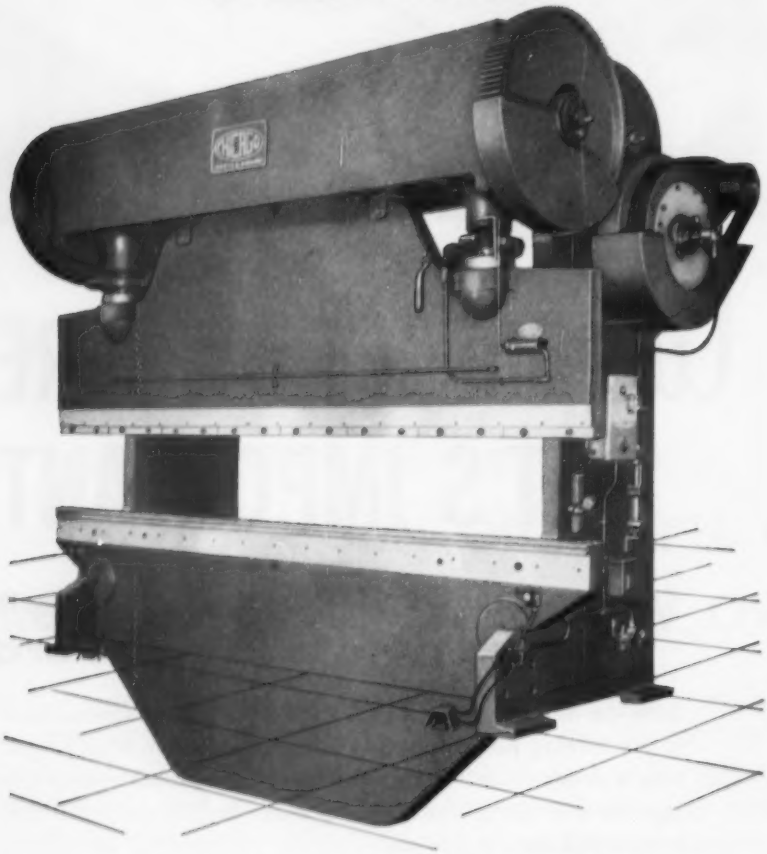

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outset of the industrial revolution in England, mobs of angry workers broke into the mills and tried to destroy the new machinery which they feared would leave them jobless. Today we know that it was the machine alone which enabled England to support her rapidly growing population and provide it with a rising standard of living. In countries like India and China, where mechanization did not occur, the standard of living fell far below subsistence levels and the population was decimated by starvation and disease.

Automation has been in the minds of men for centuries. Its growth had been held back until machine tools and control instruments were developed. At the present time the means are available and automation is ready to surge ahead. Automation is now ready to step out of its formative, introductory stage.

Nowadays we marvel at the modern business machine which writes checks and keeps records through the use of punch-cards. And on our production lines are other wonderful machines which are automatically controlled by a punched paper tape. But is this new? Not at all. More than 150 years ago a Frenchman named Jacquard built an automatic loom which wove all kinds of complicated patterns in accordance with instructions that were punched in paper tape.

So let us face it. This thing called automation is simple evolution—not revolution. It is only another step in the slow and plodding progress of man toward a richer, fuller life and a better, freer world.

Sing Yen
Brooklyn, NY

IT IS IMPOSSIBLE for a person of vision and foresight to see anything in the future except more and more automation producing more and

"I'll be back in a minute. That'll give Dolan time to tell you all he knows about the operation."

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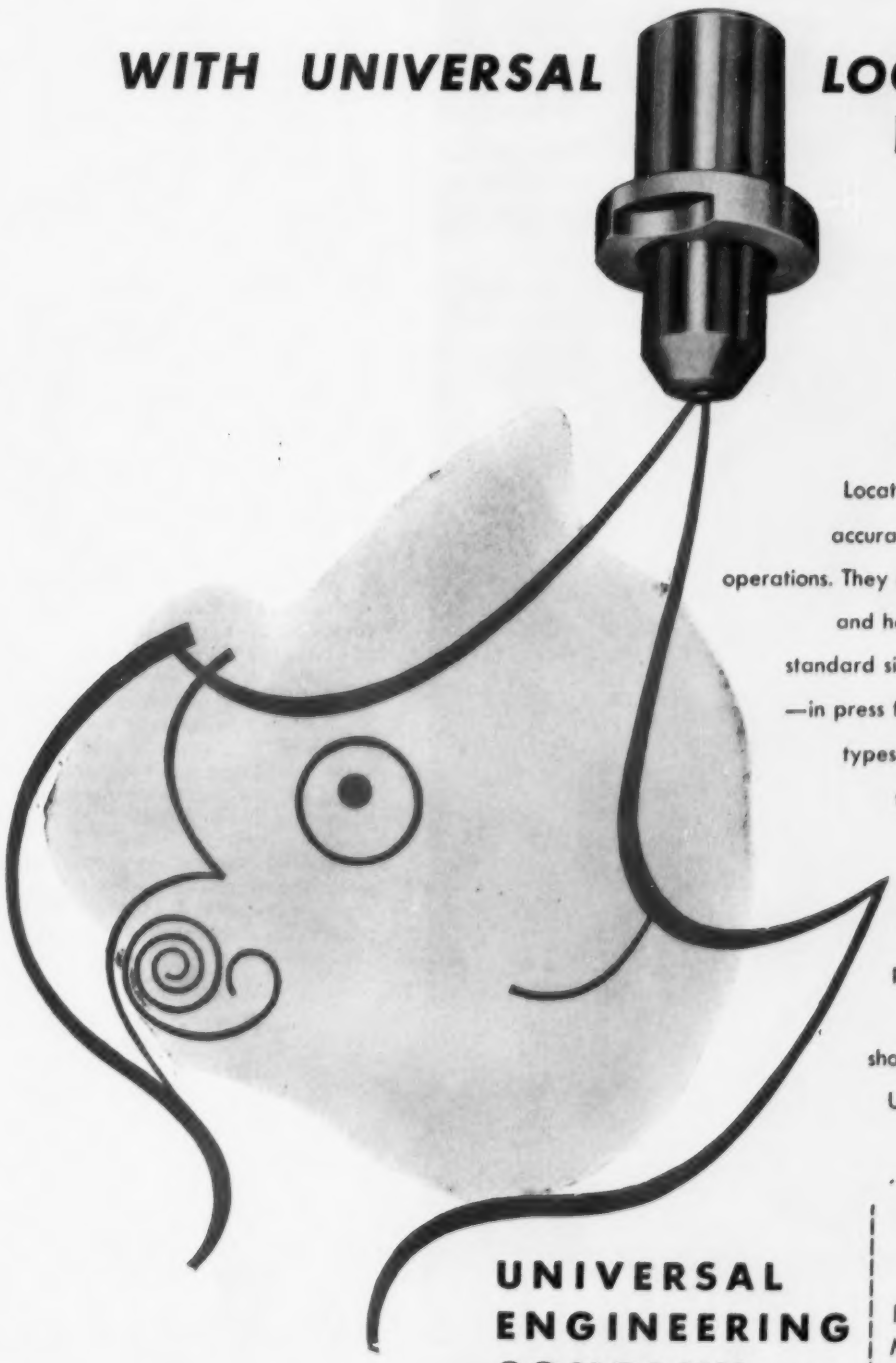

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more for everyone. Men of all ages of history have had a great desire to possess material things. It is this insatiable desire which stands behind all industrial growth.

There have been many attempts to limit or prevent the building of production machinery. It was at one of these early attempts that the word "sabotage" originated. The workers in Holland damaged the textile machinery by throwing their wooden shoes, called sabots, into the mechanism. These attempts all resulted from misunderstanding and narrow-mindedness. While it is true that the immediate effect of the introduction of a machine may be the displacement of workers, the eventual benefits outweigh this factor. The production capacity of a machine cannot be denied to the present and future generations simply because the current group of workers will be forced to seek employment in other fields. The desire for the production of this machine is too strong to be stopped by any one group.

To some people, automation means mechanization, to others materials handling, and to still others it means the pushbutton factory. Actually these words have little or no bearing on the industrial concept of automation today. The word itself is a relative newcomer to the industrial vocabulary, but the ideas and thinking to which it applies are not new. Today's industrial interpretation of automation is continuous, automatic production. It is a way of production based on the concept of manufacturing in a continuous flow, rather than processing by intermittent batches of work.

When we start talking automation and automatic factories we hear much weeping and wailing. Many people fear the principle involved; they believe that it will result in lay-

"I got my raise. Convinced him I was doing the work of two men around here. Sorry I had to drag your name into the discussion."

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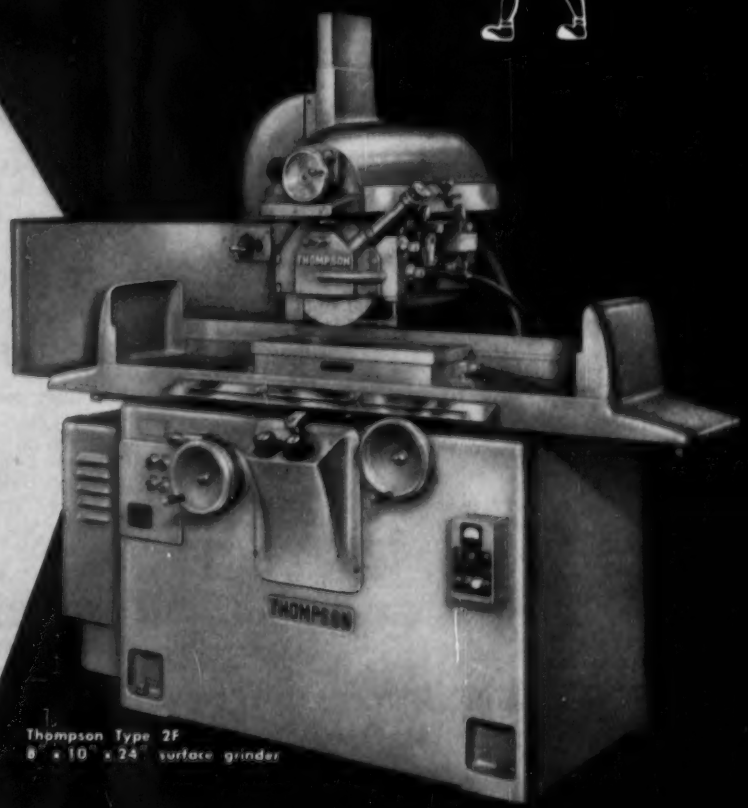

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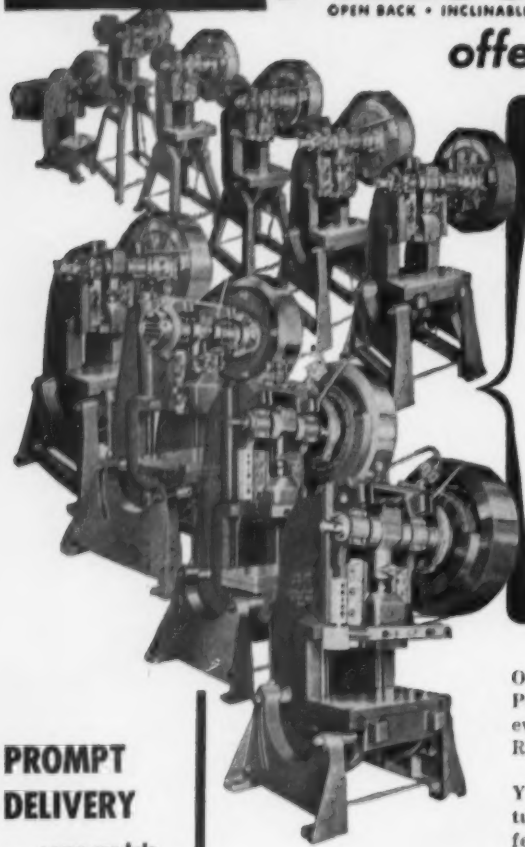

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offs and unemployment. Automation does take over jobs, but it will not result in unemployment and the people must be made to understand why. The reduction in the labor required for production can be offset by broadening the market for the product as a result of price reduction. The automatic machinery will still require men to control it and repair it. In addition, automation does not occur overnight; it is an evolutionary process. Manual, direct labor will be progressively transformed into work which will be cleaner, easier, safer, and more rewarding to the worker, who, through the process of automation itself will be trained for the more skillful accomplishments required in better jobs of the future.

Probably the most important consideration is that automation will be the solution to the predicted shortage of labor. It is obvious from the long and slow development of past years that the area of the pushbutton factory is still far ahead of us. It certainly will not and cannot come upon us suddenly.

Today the opportunities lie in doing the job at hand with the tools available, then progressively upgrading the operations and people into mechanization and automation. Automation will have to pay its own way in a step-by-step program as industry takes a practical approach to the best use of each year's technical advances in manufacture.

William Martin
Brooklyn, NY

•

SHOW DIPLOMAS HERE

Should a fixed minimum on education for shop men be set? Is it practical to demand a high-school diploma from a worker if the foreman is convinced of his potentialities, even though the man has not completed such a course?

THERE is no doubt whatsoever about education being necessary in order for one to get the utmost in life, and especially so that one makes progress in his work, but don't depreciate the really necessary virtues pertaining to one's work that are in effect second nature. I became cognizant of these innate dormant qualities as I observed the boys in my shop at school. I compared the brilliant student, who was scientifically minded and who took hold of his work as a blotter took up ink, with the boy who appeared to the lay mind as being a dullard. The future mechanic disclosed that care and patience so necessary for one to proceed with an intricate job wherein perfect fits

(Continued on page 250)

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FORGING

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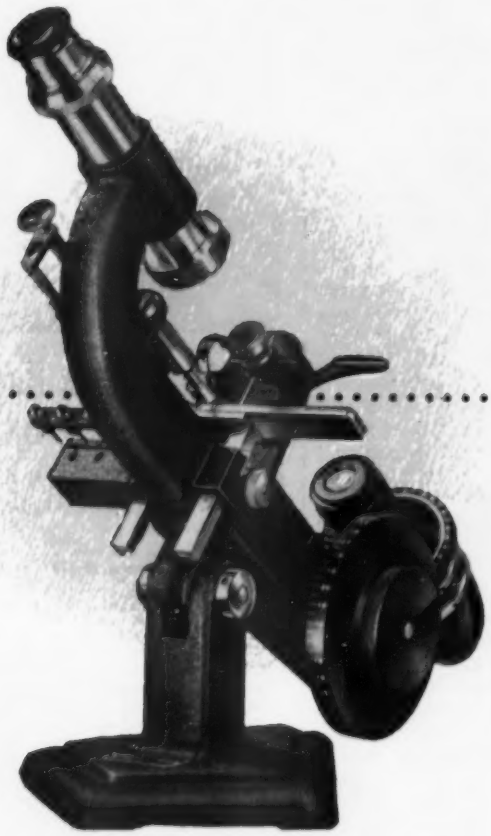

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METALS AND ALLOYS REVIEW

by FRANK M. LEVY

Vice-President and Director of Research

One of our most interesting series of alloys is the group which we market under the tradename "Tuf-Stuf" . . . a group of aluminum bronze alloys with range and flexibility to meet the most demanding needs. They are high copper base alloys containing from 9% to 13% aluminum and varying amounts of iron, nickel and manganese. Being free of zinc, they are not subject to dezincification. Tuf-Stuf alloys have a low coefficient of friction, good wearing qualities, high tensile strength, high hardness and the ability to withstand heavy pounding. Some of the alloys can be hardened by heat treatment. In the harder grades, these alloys are used for heavy duty service where high compressive loads are encountered and where lubrication may be scant. Present day increases in operating speed of modern machine equipment and the economy of little or no machine "down" time has made Tuf-Stuf popular in the machine tool industry. It is used in a multitude of applications where resistance to wear is important, such as: Drill Jigs, Feed Nuts, Rollers, Cams, Collets, Gibs, Gears, Boring Bar Guides, Lead Screw Nuts and Clutch Shifter Forks. Also, because of their ability to withstand higher stresses and resist season-cracking, these alloys are ideally suited for threaded nuts and bolts and pole-line hardware.

The unusual physical properties of the Tuf-Stuf series have made it particularly useful in the chemical and allied industries. These alloys combine the strength and ductility of medium steel with high resistance to corrosion by many chemicals. Tuf-Stuf alloys will not only resist oxidation at elevated temperatures, but will also retain a greater portion of their strength and hardness at these temperatures than will the copper zinc alloys. These properties make them ideal in the aircraft industry for valve seat inserts, spark plug bushings, valve guides and propeller hub cones.

Tuf-Stuf alloys are supplied as forgings, rod or screw machine products. As forgings the grain structure can be controlled to produce parts that are strongest at points of greatest stress and strain. Relatively intricate shapes can be forged to closer tolerances than sand castings. Where appearance is a factor, a forging may easily prove more economical since a minimum amount of machining, buffing or polishing is required before finishing.

If you'd like more information about this series of alloys, drop me a line or better yet, send me your sample part or blueprint and an explanation of its use and we'll be glad to submit our recommendations.

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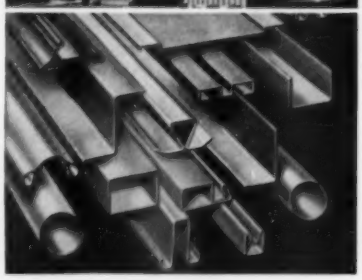
were necessary whereas the "brain" will, with eagerness to get things done, feel that he is wasting time.

It may seem that I am rather biased, and as a practical man from industry, inclined to be prejudiced toward the apple polisher who gets his grades with ease, but if we want people for the jobs that require those qualities so necessary for a well trained worker, who will be content in his job which he is able to perform with ease and be happy in doing it, we've got to recognize qualities and not certificates. A high-school diploma is no evidence of a man's fitness to handle a job, either as a machinist or a tool and die maker—in fact, any trade requiring skill.

There are men today who have not been "honored" with such things as diplomas in their remote past and the lack of them makes no difference in their ability to do a good job. They may take a back seat when it comes to dabbling into problems involving mathematics and science, but when it comes to turning out honest-to-goodness work of quality—and without loss of valuable time—you've got to give the old boys credit. We had men who turned out to be first-class workers, and still have them, before the habit of giving away diplomas became a national pastime. I mean that without any strings attached. A very great percentage of high-school diplomas are being given away simply as evidence of so many years of attendance in which many a dumb bunny stared his time away while the teacher made a frantic effort to impregnate the thick skin with something useful.

It is all very true that a high-school training, in which the pupil made an effort to get its true value by settling down to business, does fit

"We had some parts left over, when we made the earth satellite."



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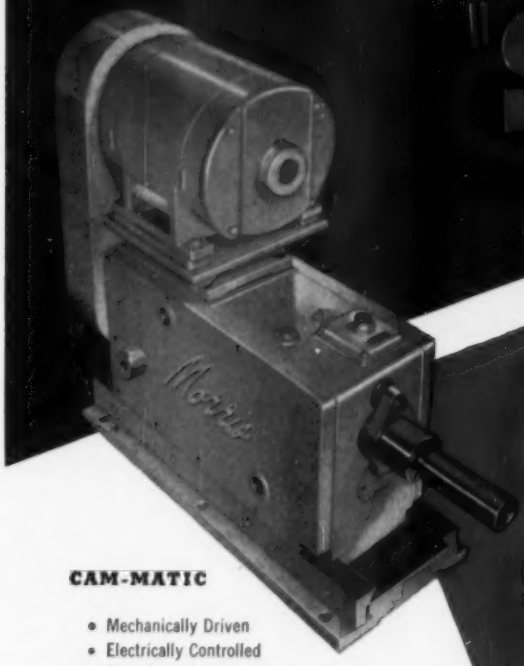

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one for any emergency in the way of advancement. However, we cannot advance all the workers. Thank the good Lord that we have the contented worker who has found his niche and does his very best to fill it. I've known men who didn't graduate from grammar school who turned out to be quality workmen who, by their sound reasoning, brought into effect many remarkable improvements in methods and tools of production. I've seen many a diploma owner turn out to be a flop.

I do not want to be misunderstood. I give credit to the lad who graduates from high school and who continues his diligence and effort in making something out of himself.

While the foreman has many things on his mind to look after, it would be to the firm's benefit if his opinion or appraisal of an applicant were recognized. I'd be sore as a boiled owl if workers were sent to my department unless I had a voice in the hiring. A good foreman can determine in a few minutes whether a man is worth taking a chance on; however, I've seen some slick rascals pull the wool over the best of foremen and get by with a few weeks' work before it was discovered that they weren't worth a tinker's damn.

Harrison Mitchell
Topeka, Kans

•

RUMOR BOARD

Can rumors be dispelled by an official company explanation posted on something similar to a bulletin board? Will employees accept such an explanation, or view it with a jaundiced eye as just some more management propaganda?

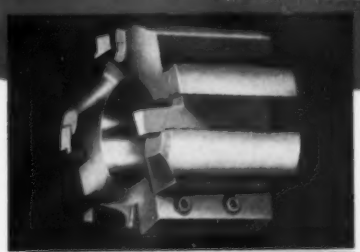
BEFORE THE All-American coffee break, the employees got a kick out of sneaking off for coffee or having it brought to them while they were working. Many employees who never drank coffee before, soon developed the habit. Some smart alec came along and established an official coffee break. It took the kick out of doing something on the sly or cheating the boss. Now it is a period of discussing rumors, griping or catching a quick nap. Many workers have given up coffee drinking, now that it is legal.

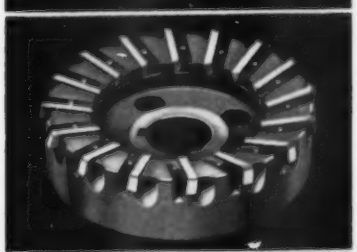
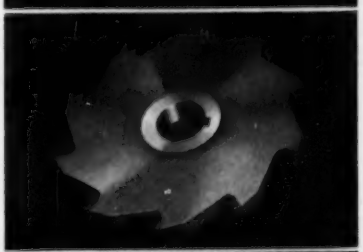
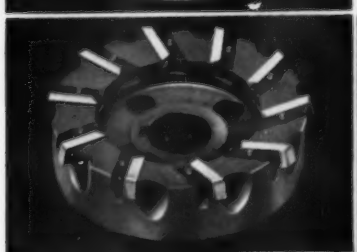
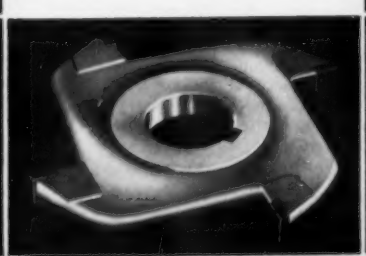
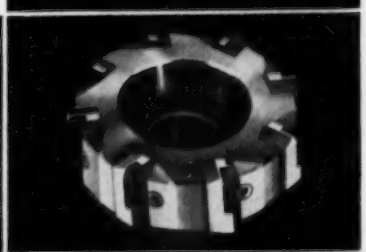
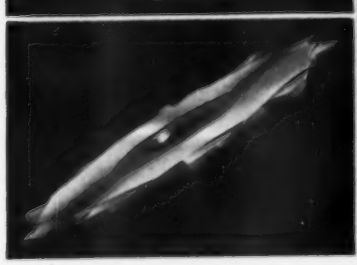
The All-American game of gripes and rumors is now being threatened by a rumor board. The poor working class is being robbed of their constitutional rights. Imagine walking through the plant and not getting some inside information on a rumor. What a monotonous life the future generation is facing, pushbutton

NEW! NEW! NEW!

SUPER TOOL STANDARD MILLING CUTTERS NOW IN STOCK WITH CARBOLOY® GRADE 370

(For your steel-cutting applications)



Super Tool's Standard Milling Cutters are now available for immediate delivery with Carboloy Grade 370. This new series of steel-cutting carbide *cuts faster, lasts longer*—operates efficiently at extremely high temperatures as proved by hundreds of actual production tests.

Write now for catalog No. 55, describing the complete line of Super Carbide Tools.

Subsidiary Van Norman Industries, Inc.

QUALITY CARBIDE TOOLS SINCE 1927

Super TOOL COMPANY

Dept. 343 21650 HOOVER RD. • DETROIT 13, MICHIGAN

WAREHOUSES: CHICAGO — DETROIT • NEW YORK • LOS ANGELES

FINISHED AFTER HARDENING . . .

Hanson-Whitney

MULTIPLE THREAD MILLING CUTTERS

Over 35 years of experience in designing and manufacturing top quality multiple cutters has established Hanson-Whitney first in the field. Hanson-Whitney's exclusive *finished after hardening* process provides extremely close limits in tooth spacing, form and relief. Ground thread cutters assure minimum outside diameter run-out . . . does not restrict the length of thread to be milled, while maintaining tolerances of parallelism or desired taper.

Hanson-Whitney Cutter Insert design, where applicable, meets today's demand for savings in tool costs. Hanson-Whitney Adapters, to suit cutter spindle tapers, accommodate Cutter Inserts. Adapters and Cutter Insert Blanks are carried in stock to expedite delivery.

Hanson-Whitney alone offers *single source* product integrity — machine tools, cutting tools, and precision gages for screw threads . . . your guarantee of production perfection. Consult Hanson-Whitney engineering service in the field or at home address. Write for further information and literature —

Hanson-Whitney

COMPANY

DIVISION OF THE WHITNEY CHAIN COMPANY

170 BARTHOLOMEW AVENUE • HARTFORD 2, CONNECTICUT

TAPS • THREAD GAGES • DIES • CENTERING MACHINES THREAD MILLING MACHINES AND CUTTERS

controls, coffee breaks, paid vacations, pensions, insurance, unemployment benefits, guaranteed annual wages—and no rumors.

How can their curiosity be aroused? What can they discuss on an equal plane with their fellow men? What will keep them awake nights? What will they have to worry about? Please do not take their rumors away. Leave them some insignificant crumbs to whet their worried appetites. In fact, I heard a rumor that the company is going to install a rumor board next week. I wonder what they will post first? Will it be about the layoff, our raises, or the vacation with all expenses paid? If they announce their profit for the last quarter, I'll bet it's only half of it. They made a million. Well, I'll see you at the Rumor Board!

Frank J Zarnowski
Rutherford, N J

Names in the News . . .

A P Bowman has been appointed manager of the Rockford, Ill, district office of Allis-Chalmers Industries Group. He was previously a general purpose equipment sales representative in the Chicago district.

Philip O Waggoner, supervisor of the material and production control department of Capehart-Farnsworth Co's Flora, Ind, plant, has been promoted to plant manager.

Lieut Gen Laurence C Craigie (USAF, ret), a vice president of Hydro-Aire, Inc, Burbank, Calif, has been appointed vice president, engineering.

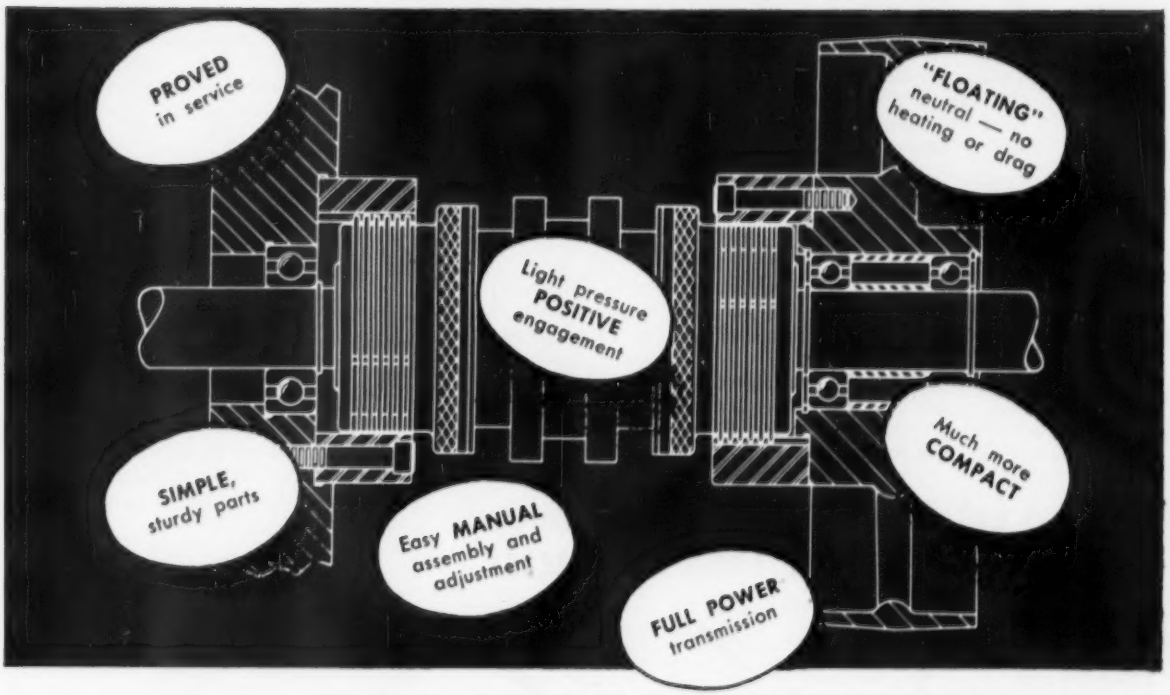
Roy E Wendahl, director of sales for the Hughes Aircraft Co in Culver City, Calif, has been named manager of the guided missile plant at Tucson, Ariz. He succeeds **William W Woodridge,** promoted to vice president in charge of administration at Culver City.

Garnett A Vining has been named western regional sales manager for Yale & Towne Manufacturing Co's Materials Handling Division. Mr Vining was formerly manager of Yale gas-powered industrial truck sales.

Henry E Little has been named general superintendent in charge of operations at the Cleaver-Brooks Co

ASSURE YOUR PRODUCT THE *PROVED* SUPERIORITY OF A

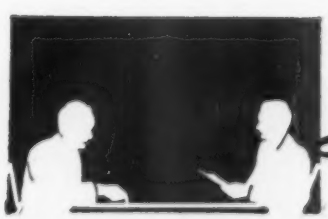
MAXITORQ *floating disc* CLUTCH


PROVED in service
"FLOATING" neutral — no heating or drag
Light pressure POSITIVE engagement
SIMPLE, sturdy parts
Much more COMPACT
Easy MANUAL assembly and adjustment
FULL POWER transmission

The line drawing shows typical application of a double Maxitorq Floating Disc Clutch, arranged for both drive and brake, with ring-type driving cups.

Such installations have a well-proved record of efficiency and freedom from maintenance. Drive and brake engagement and disengagement are smooth and positive . . . without drag or heating . . . because exclusive MAXITORQ design assures that discs ride free in neutral.

MAXITORQ Floating Disc Clutches are available in a wide range of sizes and types . . . single, double, overload release . . . to meet specific installation demands. Our engineering department also stands ready to help you solve special drive problems. Write or phone Dept. AM-5. The Carlyle Johnson Machine Company, Manchester, Conn.



Let's talk **MAXITORQ**

BESLY

Precision Tooling and Gaging Application Service

- *SAVES YOU ENGINEERING HOURS*
- *GIVES YOU HIGH PRODUCTION*
- *REDUCES YOUR COSTS*

Determining the style and type of cutting tools and gages that will do a given job best often takes engineering hours that you can ill afford to spare these days.

You can save many of these hours with Besly's Application Service. Besly Service Engineers are completely up-to-date on cutting tool and gage selection and application. They can analyze your jobs, select the right tool, and help lay out tooling set-ups to achieve longer tool life, less downtime, fewer rejects, and increased production. This service includes the development of "special" tools to fit your special needs. If you'd like proof of how it can work for you, write us.

You Get Assured Cost-Cutting Quality with Besly Cutting Tools and Gages!

COMPLETE LINES

PRECISION ACCURACY AND QUALITY

STANDARDS AVAILABLE FROM STOCKS

FAST DELIVERY ON "SPECIALS"

Engineering, Service, and "Specials" are a BESLY SPECIALTY!

BESLY TAPS

BESLY DRILLS

BESLY REAMERS and END MILLS

BESLY HIGH SPEED TOOL BITS

BESLY METRO CARBIDE TIPPED TOOLS standard and special

BESLY METRO GAGES

BESLY

BESLY-WELLES CORPORATION

Est. as C. H. Besly & Co., 1875

120 Dearborn Avenue • South Beloit, Illinois

plant now under construction in Lebanon, Penna. He was formerly chief engineer and assistant superintendent of the fabricating and stamping divisions of Phoenix Iron & Steel Co, Harrisburg, Penna.

Clark Hague, formerly associated with Askania Regulator Co, Chicago, now heads the Hague Regulator Corp, Orangeville, Ohio.

George D Gotschall, production manager for Steel Improvement & Forge Co, Cleveland, has been promoted to director of manufacturing.

Charles J Craft, service engineer for Snyder Tool & Engineering Co, Detroit manufacturer of automated special machine tools, has been named service manager.

Ralph L Clark has been appointed supervisor of Portland Copper & Tank Works' stainless steel fabricating department.

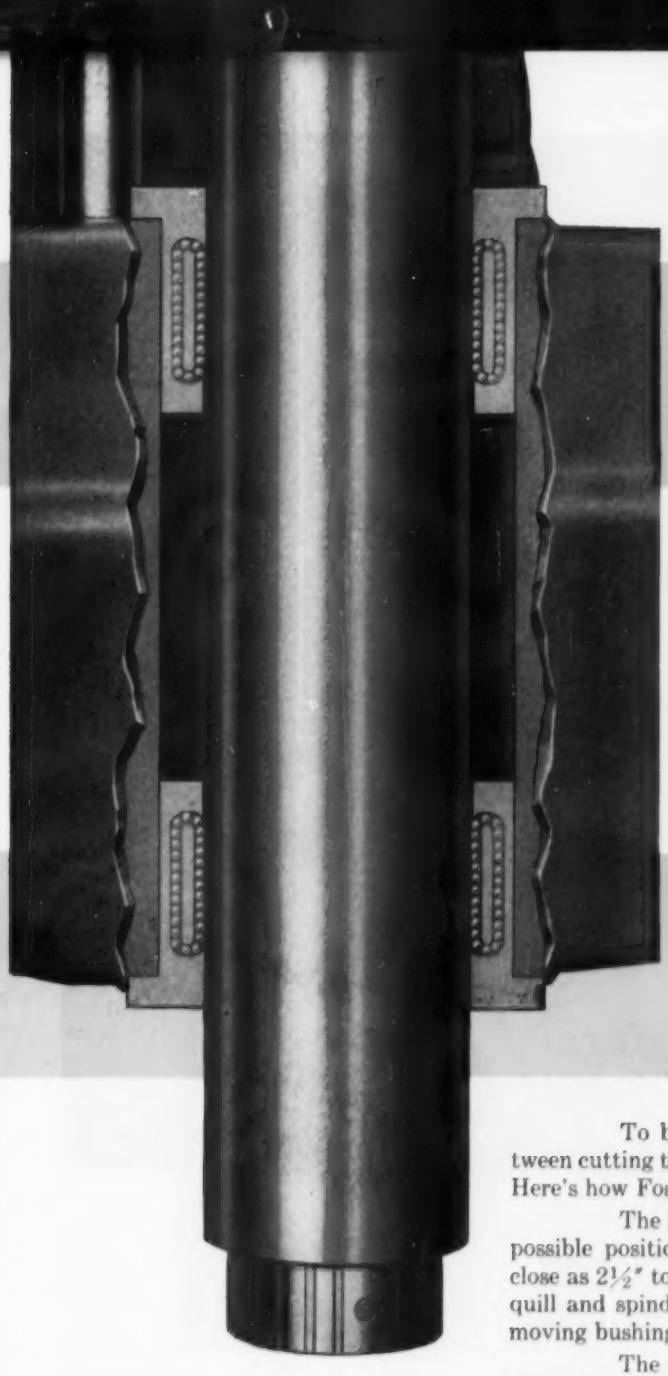
Ambrose J Wardle Jr, assistant president, and vice president of sales of McKay Machine Co, has been elected president of the firm, Youngstown, Ohio, manufacturer of sheet, tin, and strip mill equipment. He succeeds **Harvey D Miller** who has retired from active duty, but will continue to serve in a consulting capacity.

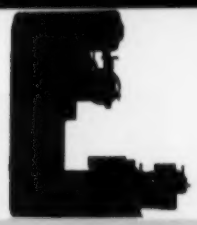
Arnold Wihtol, general assembly foreman for Varian Associates, Palo Alto, Calif, electronics firm, has been named production superintendent. **George Reyling,** product engineer, has been appointed assistant manager of production engineering.

Howard J Warwick, factory manager for Addressograph-Multigraph Corp, Cleveland, has been appointed director of manufacturing. **William F Daniels** succeeds Mr Warwick. **James A Ferguson,** assistant factory supervisor, has been named general superintendent.

James G Kennedy, formerly general manager of Mitchell-Bentley Corp, Owosso, Mich, has been appointed vice president and general manager of American Electric Motors, Toledo, Ohio. The company is a recently organized subsidiary of American Floor Surfacing Machine Co.

E L Miller has been elected assistant general manager of Cooper-Bessemer Corp, Mt Vernon, Ohio.





NEW QUILL BEARING DESIGN helps achieve extreme precision in Fosmatic Jig Borer

Eight models available from the low-cost Model 30 with 36" x 18" table, to the virtually automatic model 54P with 54" x 22" table. Other important features: Automatic Positioning, choice of two precision measuring systems, milling feed, rapid traverse to quill, power clamping of table and saddle, coolant system and reversing motor control for tapping.

To bore with precision as close as ±.0001", distance between cutting tool and lower quill bearing must be held to a minimum. Here's how Fosdick minimizes this crucial distance.

The lower quill bearing is *permanently* located at the lowest possible position in the head, permits boring with spindle nose as close as 2½" to the bearing. Bearing does not ride up and down with quill and spindle as in conventional designs where balls are held in moving bushings.

The permanent location of quill bearings is made possible by unique Fosdick design—vertical ball races with preloaded precision balls circulating continuously. This design also permits spindle and quill to be shorter; thus stronger and more rigid. Both are perfect cylinders with no cuts on the outside.

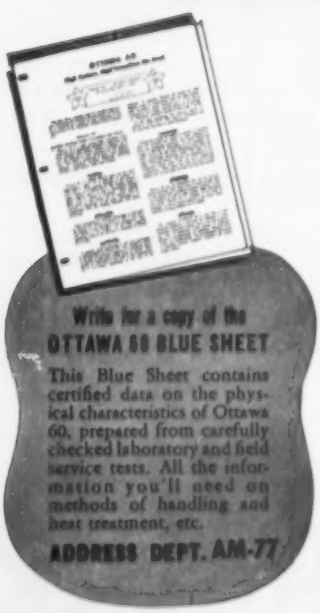
Engineering advancements like this make the Fosmatic Jig Borer the most rigid and precise boring machine you can buy. Write today for the new catalog.

NEED JIG BORING EQUIPMENT? GET A PROPOSAL FROM FOSDICK!

Fosmatic Radial Drills | Jig Borers | Sensitive and Upright Drills | Sensitive Radial Drills | Jig Grinders | Automatic Positioning Jig Borers

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

FOSDICK


Write for a copy of the
OTTAWA 60 BLUE SHEET
This Blue Sheet contains certified data on the physical characteristics of Ottawa 60, prepared from carefully checked laboratory and field service tests. All the information you'll need on methods of handling and heat treatment, etc.
ADDRESS DEPT. AM-77

OTTAWA 60 is a *new* die steel, an A-L "original," developed primarily to deep draw and form stainless steel. As intended, it performs without galling or pickup and shows exceptional wear resistance in that service. We have plenty of case histories to show you in proof.

But *wherever* you use Ottawa 60 draw dies—not just on stainless steel—this high-carbon, high-vanadium alloy comes through for you. Illustrated above are the first and second draws on transformer housings, produced from .037" gauge SAE 1010 strip. The company formerly used dies made of 5% chrome air-hardening die steel—and later a more highly alloyed material—without ever getting more than about 2000 pieces before the dies began to show gall marks and pickup, and parts were rejected due to scoring, breakage and oversize. *Dies made from Ottawa 60 forgings cured that! Results after 25,000 pieces showed no pickup and no wear on punch or die.*

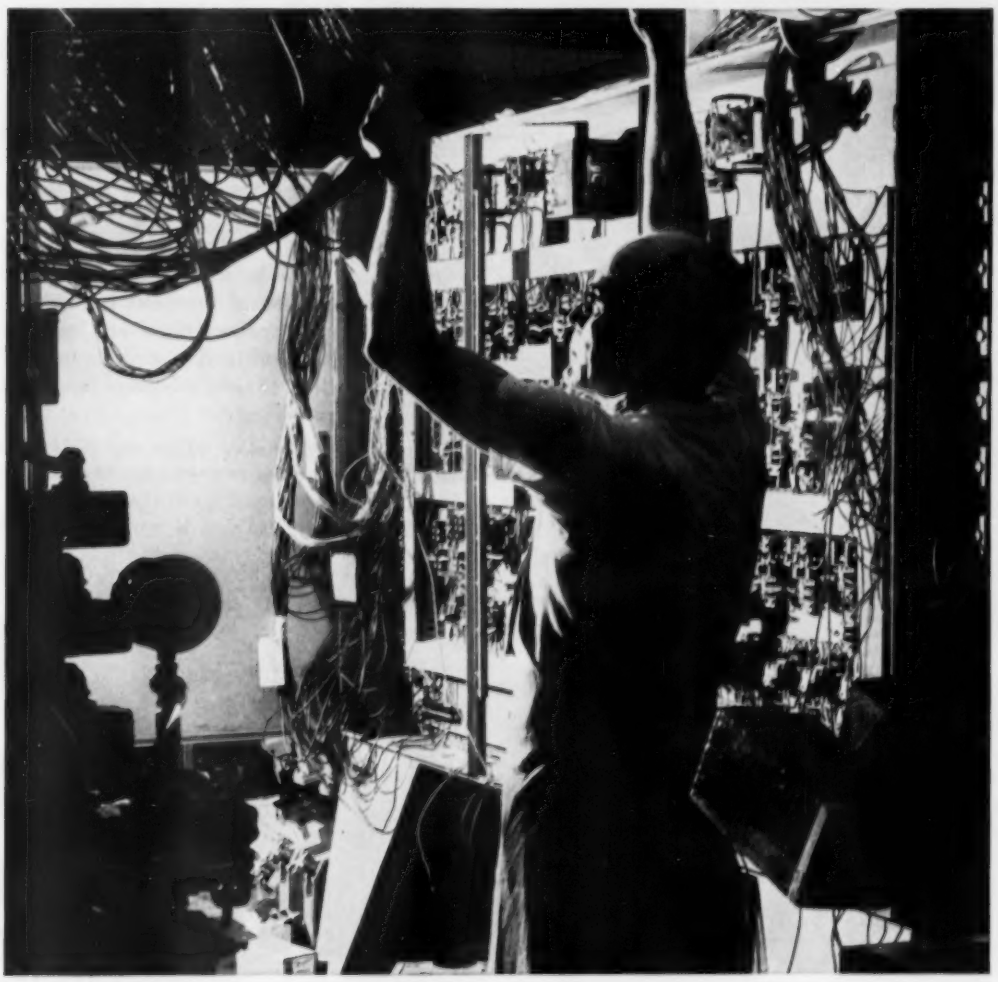
● You can solve many a problem and save real money with Ottawa 60 draw dies! Write for information or call in our Field Service Staff to help you get started.

For complete **MODERN** Tooling, call

Allegheny Ludlum

AL® FINE TOOL STEELS SINCE 1854

Operation *AUTOMETROLOGY



The central nervous system goes into an automatic gaging machine which will soon allow an antifriction bearing manufacturer to make significant production savings. To be specific it will:

- Eliminate the need in the assembly area of a large inventory of bearing parts and the space that inventory occupied.
- Materially reduce the percentage of scrap.
- Greatly increase the production rate of dimensionally acceptable bearings.

This and all other automation projects are handled by Sheffield's Research Division. Sheffield has the over-all experience and the skilled technicians to make automation productive for you. Let Sheffield engineers help plan your automation project. Call the Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 1.

* AUTOMETROLOGY *—The science of automatic gaging and dimensional classification—also the control of production machines to hold product within prescribed dimensional limits.*

MASTER CRAFTSMAN GOLDEN ANNIVERSARY HEADQUARTERS

SHEFFIELD

manufacture and measurement for mankind

7429

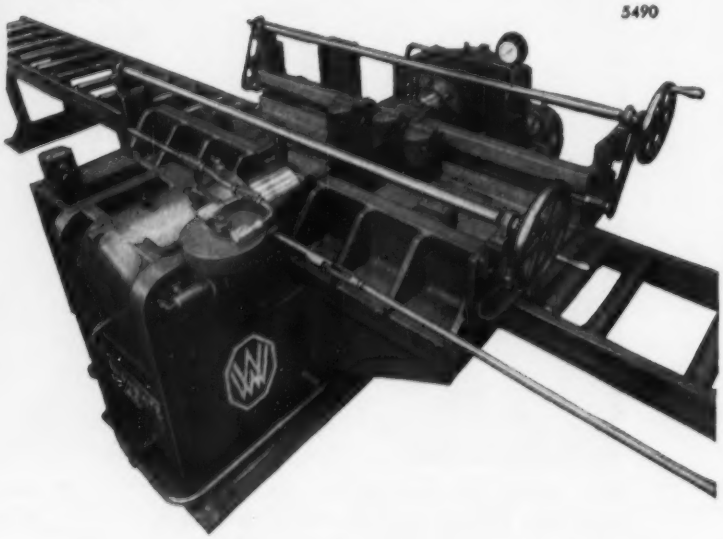
Beat Production Dead-Lines with a WILLIAMS-WHITE Double-End BENDER and STRAIGHTENER

5235

The two moving crossheads of the WILLIAMS-WHITE Hydraulic Double-End Bender and Straightener make it possible to bend or straighten either or both sides of a section. This feature . . . the sensitive control, adjustable stroke and cushioned "squeeze" provided by the hydraulic unit reduces handling, increases production in any shop in which bending or straightening operations are performed.

For more information, see our Representative nearest you or write us direct.

5490



REPRESENTATIVES

FRANK RYMAN'S SONS
Pittsburgh, Pa.

A. L. BECHTEL & SON
Cleveland, Ohio

IRVING R. GARD & CO.
Seattle, Wash.

WILLIAMS-WHITE & CO.
Chicago Office:
J. E. Maynard, Mgr.
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ALLIED NORTHWEST
MACHINE TOOL CORP.
Portland, Ore.

E. E. WOOD MACHINERY CO.
Detroit, Mich.

PAGEL MACHINERY COMPANY
Milwaukee, Wis.

SEIFREAT-ELSTAD MACHINERY CO.
Cincinnati, Columbus and
Dayton, Ohio

EDWARD A. LYNCH MACHINERY CO.
Wynnewood, Philadelphia, Pa.

GEORGE A. DAVIES, Jr. MACHINERY CO.
Los Angeles, Calif.

SPECIFICATIONS:

	5235	5490
Capacity, in either direction	75 tons	75 tons
Stroke, maximum	8 inches	12 inches

(5490: Bending blocks adjustable by operating hand wheel)

BUILDERS OF MACHINERY SINCE 1854

WILLIAMS-WHITE & Co.

304 EIGHTH ST. • MOLINE, ILLINOIS

PRESSES • BULLDOZERS • BENDERS • PUNCHES • SHEARS

"The right quench oil for our work is

SHELL VOLUTA OIL 23"

says Garland Wilcox, Chief Metallurgist
Wallace Barnes Co., Bristol, Conn.

...the story of a profitable change

WALLACE BARNES COMPANY and steel springs have "gone together" for nearly a century. Most of today's output is in SAE 1075 or 1095 steel.

Because the quenching operation is so important to the life of springs, the Wallace Barnes laboratory decided to test its regular quenching oil against some of the newer products, including Shell Voluta Oil 23. This is what they found:

Shell Voluta Oil 23 showed a superior quench rate, with correct hardening and relative freedom from distortion. It drained more rapidly from the quenched parts, reducing dragout loss. It washed off more completely in the alkaline cleaner; it reduced flaming, and cut down on the oil baked to parts.

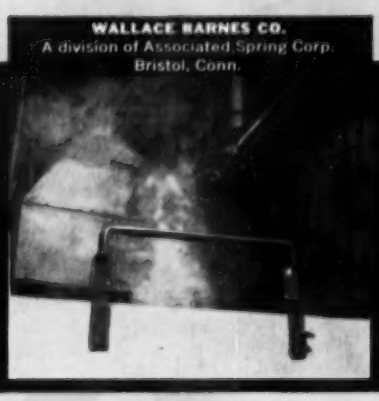
Wallace Barnes reports that this oil has almost eliminated trouble with "slack-quenched parts," and that heavier stock now goes through without special handling. So . . . Shell Voluta Oil 23 has replaced the former quench oil in all tanks of the spring hardening departments, serving salt pot lines and shaker hearth furnaces.

We'll be glad to provide full information on Shell Voluta Oil 23.

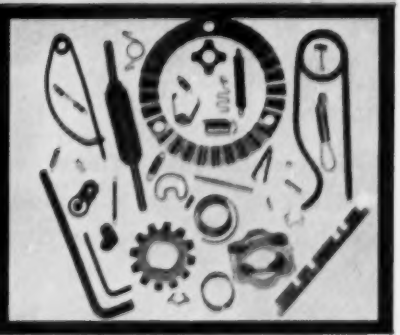
WALLACE BARNES CO.
A division of Associated Spring Corp.
Bristol, Conn.

Photos courtesy "STEEL"

Shaker hearth furnaces automatically dump parts into Shell Voluta Oil 23, then remove and drain them.



Flat springs at austenitizing temperature get a fast quench in Shell Voluta Oil 23.



Over 35,000 prints of production items like these are kept on file at Wallace Barnes Co.

SHELL OIL COMPANY

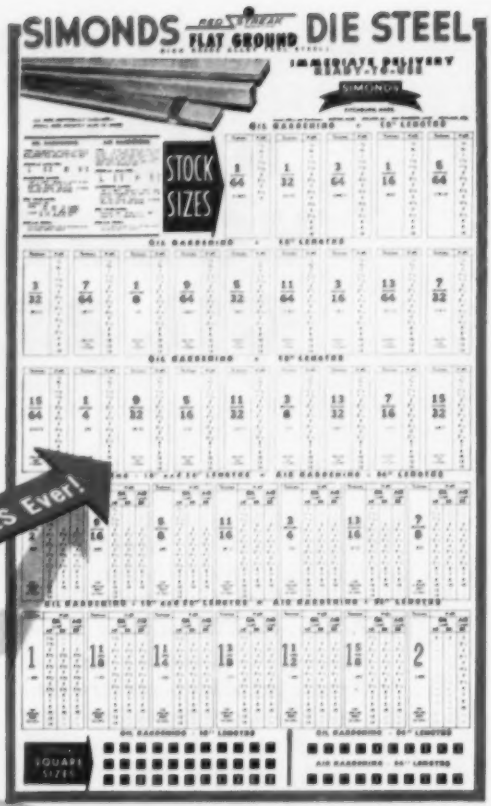
50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

There are no
HIDDEN COSTS
when you Buy

SIMONDS

Flat Ground Die Steel
It's Ready to Use!



Ask your Simonds Distributor for a copy of this New Chart (18" x 31") giving full range of Stock Sizes now available.

First cost is only part of the story when figuring die steel costs. Bar for bar you save with Simonds. Simonds Flat Ground Die Steel requires no costly grinding to size. It's *already* precision ground to 1001 stock sizes. What's more it's uniformly annealed and readily machinable. You save on time. You get better results . . . have a choice of OIL Hardening or AIR Hardening type.

OIL-HARDENING TYPE — Non-deforming, spheroidize-annealed for best machinability and consistently uniform hardenability — from Simonds' own steel mill. Extra-smooth finish with all decarburization and surface defects removed. Wide hardening range. Individually packaged (18" and 36" lengths) with simplified heat treating instructions.

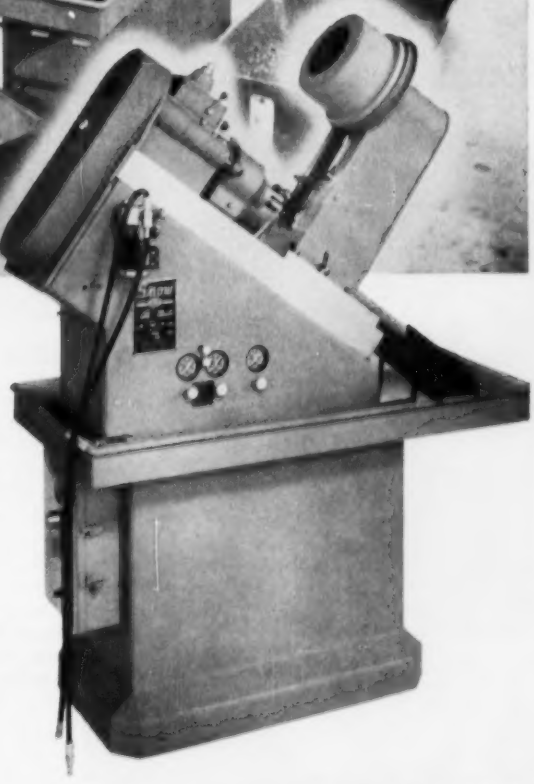
AIR-HARDENING TYPE — Non-deforming, spheroidize-annealed, 5% chrome — more wear-resistant yet easy to machine and heat treat with uniformly excellent results. Another product of Simonds' steel mill. Extra-smooth finish with all decarburization and surface defects removed. Wide hardening range. 36" lengths. Individually packaged with heat treating instructions.

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

For Fast Service from Complete Stocks
Call your
SIMONDS Industrial Supply DISTRIBUTOR

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon, Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Heller Tool Co., Newcomerstown, Ohio, Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

Automatic NUT TAPPING MACHINES



This installation *at Shakeproof, Division of Illinois Tool Works, Elgin, Illinois,* is an illustration of productivity—*with precision.*

Simplicity of set-up and lower operational costs can make your Nut Tapping Department one of the most efficient and profitable in your plant. Submit samples and prints for a comparison with your present method.

VERTICAL DRILLING MACHINES
VERTICAL TAPPING MACHINES
VERTICAL THREADING MACHINES
TWO SPINDLE MACHINES
ANGULAR MACHINES
NUT TAPPING MACHINES
HORIZONTAL MACHINES
DRILLING AND TAPPING UNITS
AUTOMATIC JIGS AND FIXTURES
DRILL PRESS TAP HEADS

SNOW
MANUFACTURING COMPANY
435 EASTERN AVENUE, BELLWOOD, ILL.
(Suburb of Chicago)

CLEEREMAN

DRILLING MACHINES

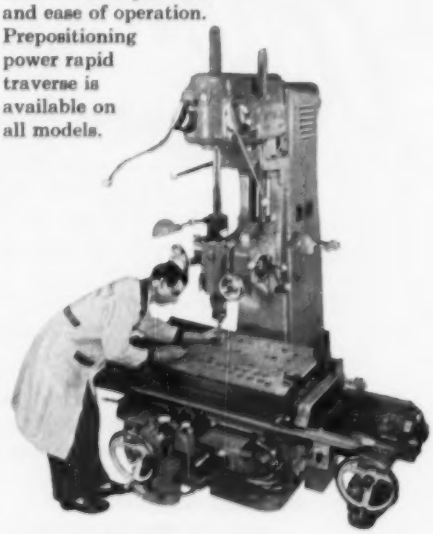
A battery of box column and round column Cleereman Drilling Machines on production work. One of many such installations producing at lower costs with higher production, less operator fatigue and no down time.

LAYOUT DRILLING MACHINE

A modern solution to an old problem. Built for those tool room and manufacturing jobs which do not require the ultra precision of Cleereman Jig Borers. The Cleereman Layout Machine is an economical machine capable of locating within .001″ per foot and drilling, boring, reaming, tapping, etc., with utmost operator ease at a fast rate of production.

JIG BORER

Unexcelled precision for ultra-fine tolerances on highest quality gage, tool, die, jig and fixture work and on "jigless" production. Combines stamina with precision and ease of operation. Prepositioning power rapid traverse is available on all models.



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• Company •
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640 West Washington Blvd., Chicago 6
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CLEEREMAN MACHINE TOOL CORP., Green Bay, Wis.

flow-matic...

The Container Line That's Changing Industry's Handling Habits

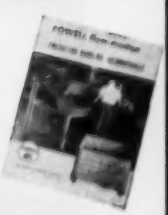
● Thoroughly tested—proved the easiest, fastest, most inexpensive method for handling of parts and components in mass production operations — the **Powell Flow-matic* System.**

Wherever this system has been set into operation handling costs have been substantially reduced. Those who have seen it in operation agree its the finest yet . . . sure to effect a great change in the handling habits of industry.

Before you buy, let a Powell representative show you the many advantages of Flow-matic*. We're certain you'll be glad you did.

*T.M. Powell Pressed Steel Co.

POWELL PRESSED STEEL



Write for free brochure that gives full details of new Powell Flow-matic* System of handling materials in production.

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THE POWELL PRESSED STEEL CO.
HUBBARD, OHIO
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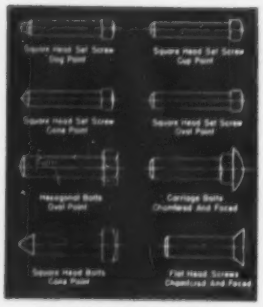
ECONOMY Automatic Pointing Machines

Save Time and Money!

TYPE 3300



Typical parts machined on the TYPE 3300

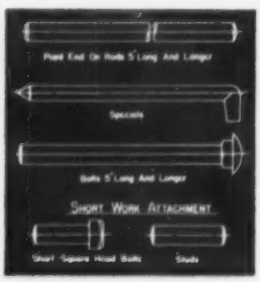
ECONOMY Automatic Pointing Machines are hopper fed and automatic in operation. These features enable operator to run several machines resulting in greater productivity and lower costs.

These Automatic Pointers are available in two sizes—Type 3300 for uniformly pointing bolts and screws to 3/8" diameter and 3/4" to 3-1/2" in length, the type 4600 for pointing bolts and cap screws 1/4" to 3/4" diameter and 1" to 6" in length. A single machine will handle all types of points on many types of bolts and cap screws.

Production rates of the type 3300 vary infinitely from 2,000 to 6,000 finished parts per hour and on the type 4600 from 1800 to 5400 per hour.

Also available is the type "P" Semi-Automatic Pointing Machine for pointing bolts, cap screws, studs and rods 1/4" to 1-1/2" diameter, 5" or more in length. Production rates up to 2,000 pieces per hour make it a valuable secondary machine for short runs.

Consult ECONOMY on low cost, high production Bolt and Screw Pointing operations.



Typical operations performed on TYPE "P" Semi-Automatic Pointing Machines

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Automatic Shaving Machines
Automatic Pointing & Shaving Machines
Automatic Pointing & Threading Machines
Double End Automatic Pointing Machines
Automatic Pointing Machines
Semi-automatic Pointing Machines

THE ECONOMY ENGINEERING CO.

WILLOUGHBY, OHIO

Designers and Manufacturers of Secondary Operation Machines since 1915

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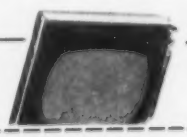

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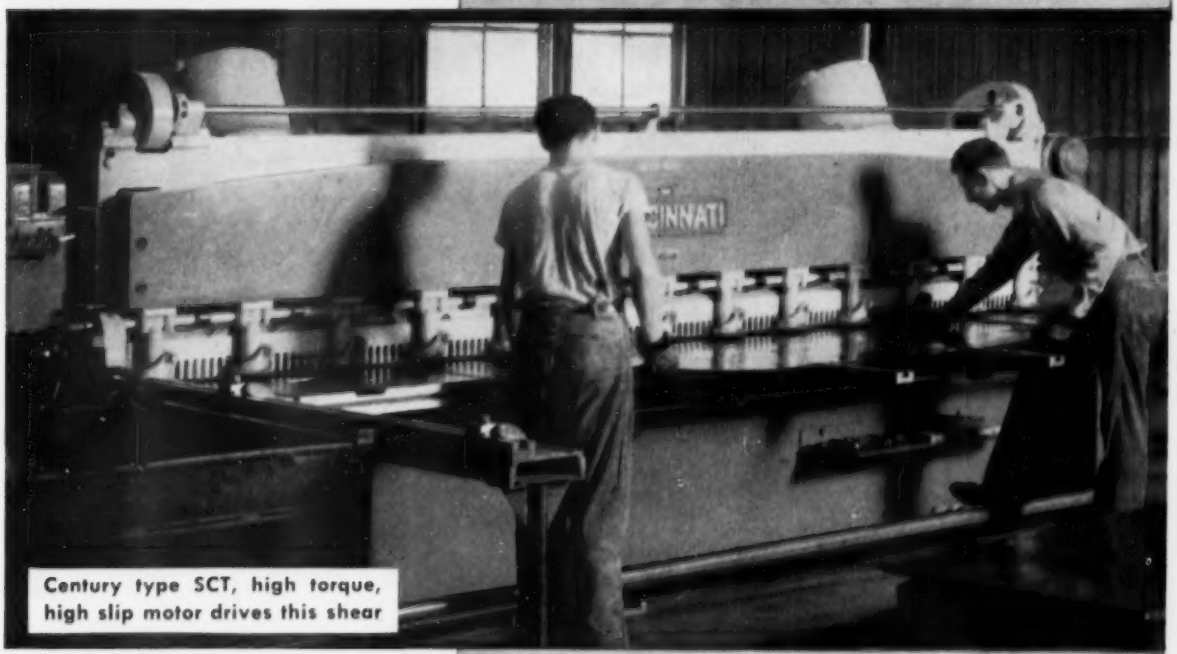

Century type SCT, high torque, high slip motor drives this shear

Century

Performance-Rated© MOTOR EXACTLY FITS THE NEED ON THIS SHEAR

To get full value from your equipment, motor *performance* must match machinery *requirements*. Whether the horsepower need is large or small, Century Performance-Rated Motors can supply the performance characteristics you require.

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Century Performance-Rated Motors are designed in a wide range of torque, speed, mounting and frame characteristics. Call your nearby Century authorized distributor, or contact our District Sales Office.

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50 times more Gun Barrels with Talide® blades . . .

Leading Arms Producer reports outstanding service life with Talide centerless blades over past 10 years—outperforming and outlasting all other work support blades.

Part . . . . . 12 gauge shotgun barrel.

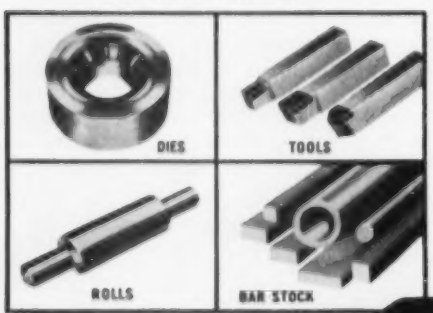
Operation . . . . . Grind entire gun barrel simultaneously to series of compound angles.

Machine . . . . . No. 5 Cincinnati Centerless Grinder.

Blade . . . . . Special Talide-tipped work support blade 34⅜" long, having 9 steps and 10 compound angles ground to .0001" tolerance.

Results . . . . . Talide-tipped blades last 150 days per grind—hardened steel blades 3 days. Several Talide blades have been in continuous production for over 5 years—being retipped with a new Talide metal wear strip every 12 to 18 months.

Tolerance . . . . . Talide blades, due to their negligible wear over long periods of service, enabled the above Arms Producer to maintain the extremely close tolerances required on the above part—and at less cost than possible with any other tooling.



One-piece Talide strip (up to 100" without seams) prevents scoring and scratching. Write for new 84-page Catalog 56-G or ask for sales engineer to call. . . . Metal Carbides Corporation, Youngstown 12, Ohio.

1,000,000 CUTS WITH TALIDE SHEAR BLADES!

A large mid-west electrical equipment manufacturer reports exceptional service life with Talide-tipped shear blades 39" long cutting silicon steel for transformers. Over 1,000,000 cuts are being obtained per blade, compared to 8,000 cuts with a hi-carbon, hi-chrome blade. Burr-free, clean-cut edges produced with scrap rate practically eliminated.

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Standard Talide-tipped blades are available from stock in over 50 styles and sizes for both Cincinnati and Landis Centerless Grinders and for either infeed or thru-feed work. Special blades to handle parts having steps, tapers or profiles can be made promptly to special order. Blades can be supplied in lengths up to 100" and ground to any tolerance or shape.

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A leading producer of scotch tape installed a set of Talide rotary slitter knives 5 years ago on a line cutting scotch tape to size. The original set of knives have, to date, cut 7,000,000 yards of scotch tape with no signs of wear—no resharpening—and no downtime experienced. Officials have decided to equip over 100 shearing machines with Talide knives as a result of the above phenomenal performance.

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OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

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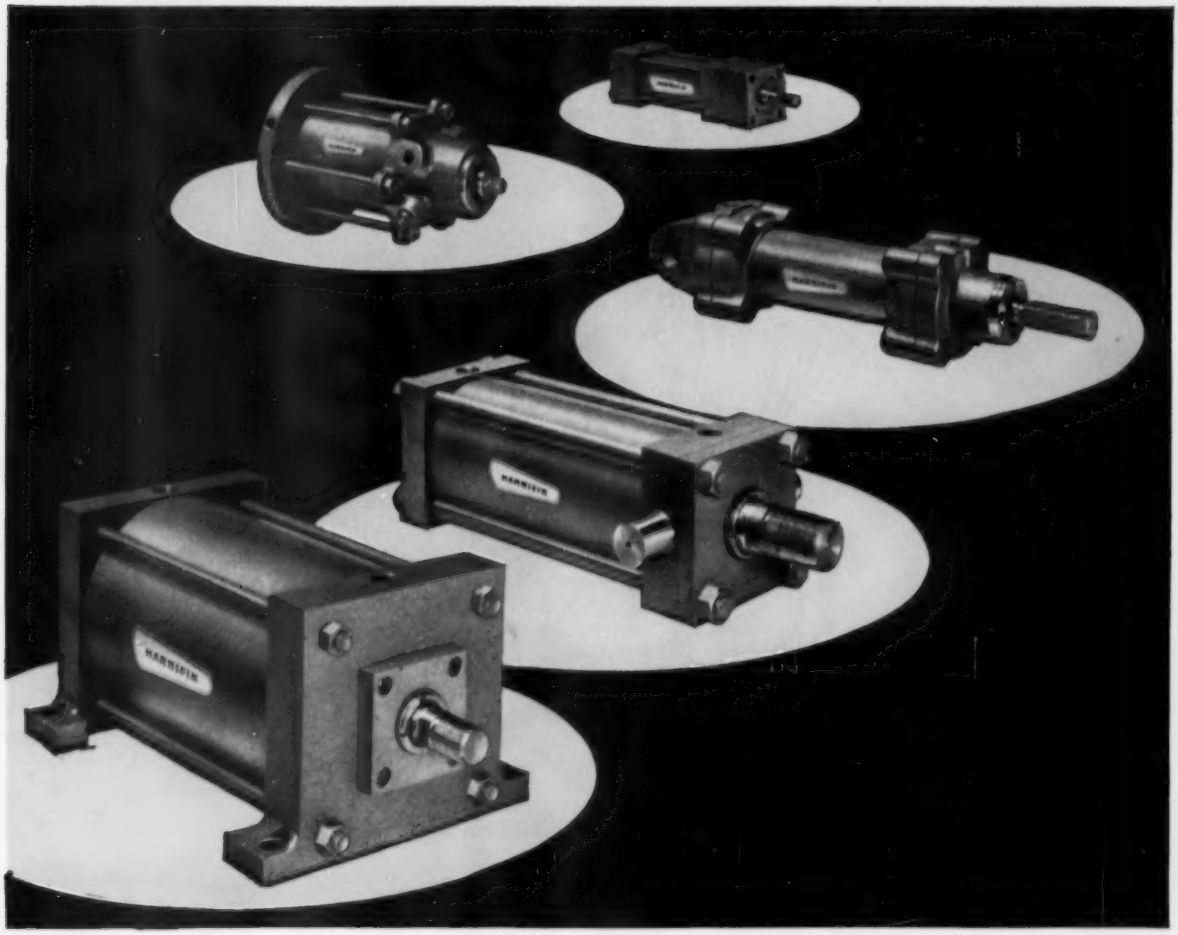

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In the selection and purchase of cylinders look for:

Completeness of Line. Hannifin makes *five* lines of air and hydraulic cylinders in a range of bore sizes and mounting styles to meet every requirement and preference.

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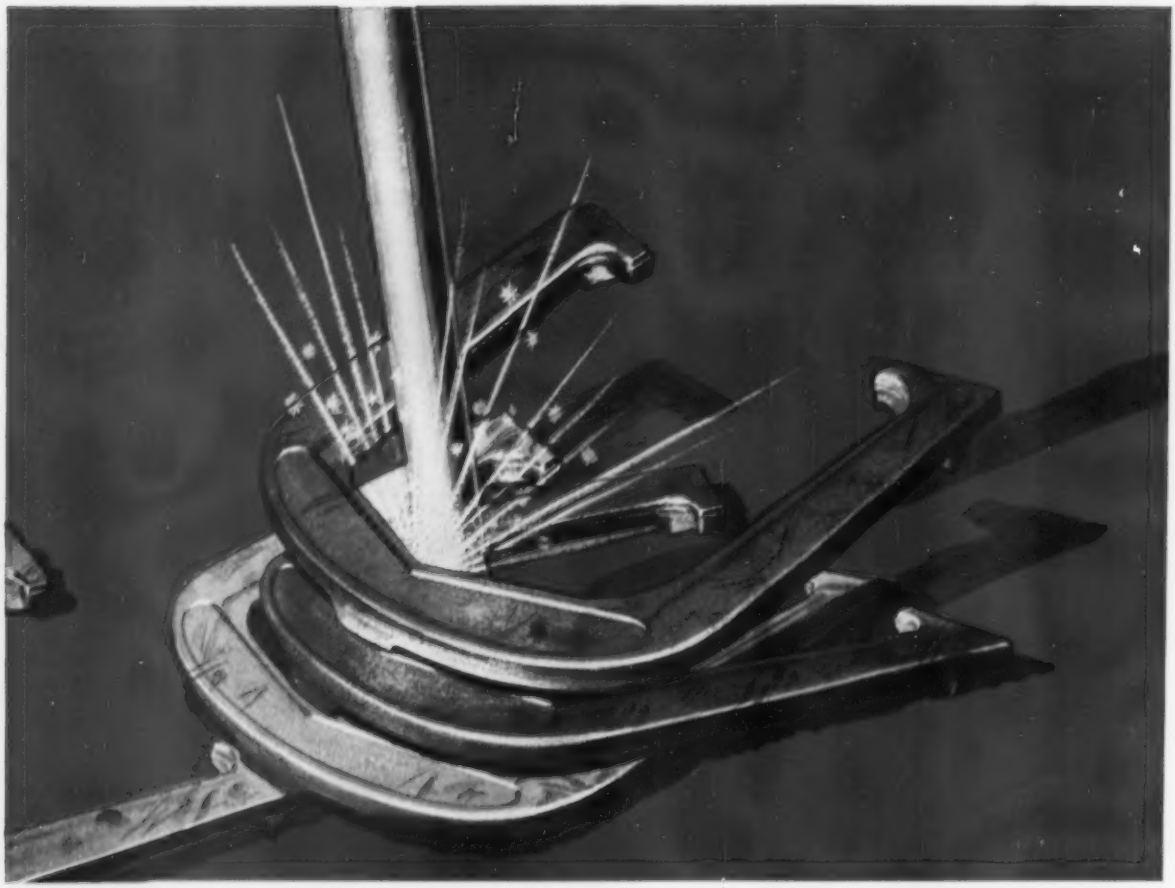


"Finish first in your league"
...with J&L COLD FINISHED JALCASE STEELS

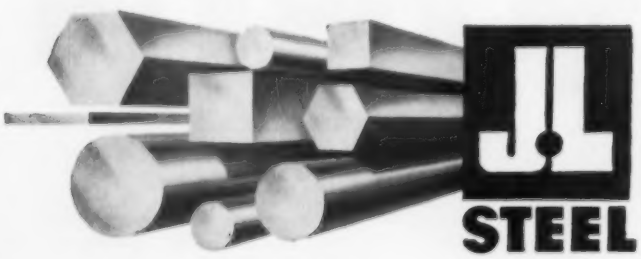
Cold Finished Jalcase—now available in 10 SAE and AISI grades—is the original free-cutting open hearth steel having the mechanical properties required for special service machined parts. And it's especially suitable for heat treating. This grade is one of a complete line of premium quality, free-machining bar steels developed over the years by J&L specialists. Thus, we can recommend the right type to help solve your particular problems.

Fundamental advantages of Jalcase are:

- Easy, consistent machinability
- Minimum distortion
- Fast, uniform response to heat treatment
- High wear resistance
- Improved cold-drawn mechanical properties

Adequate stocks are available in important industrial centers. Phone the nearest J&L District Office or your Distributor today for prompt and efficient service.

Pick the Free-Machining Steel that serves you best—from J&L's complete Cold Finished Line



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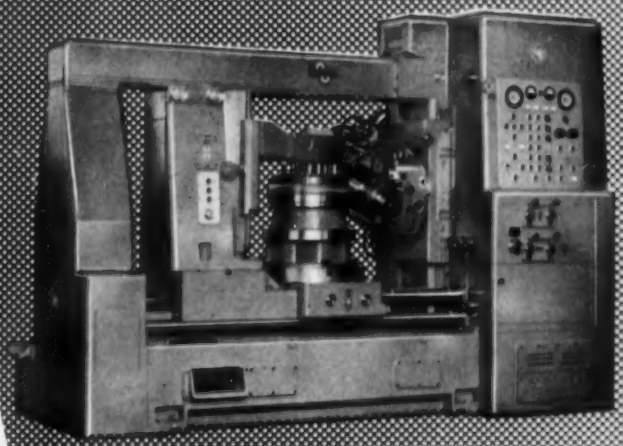


FN 9

for gear diameters up to 900 mm with work-arbor support and pitches in steel up to module 9

FP 7 production machine
for gear diameters up to 600 mm with work-arbor support and pitches in steel up to module 7

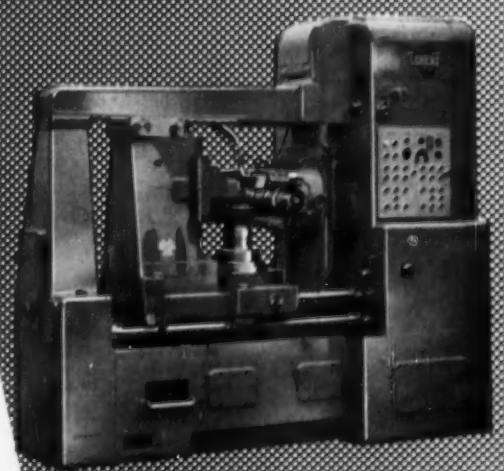
DOUBLE-FRAME GEAR-HOBBING MACHINES

with programme control for all functi... cutting time-adjustment, automatic locking

FN 6

for gear diameters up to 600 mm with work-arbor support and pitches in steel up to module 6

FP 4 production machine
for gear diameters up to 300 mm with work-arbor support and pitches in steel up to module 4



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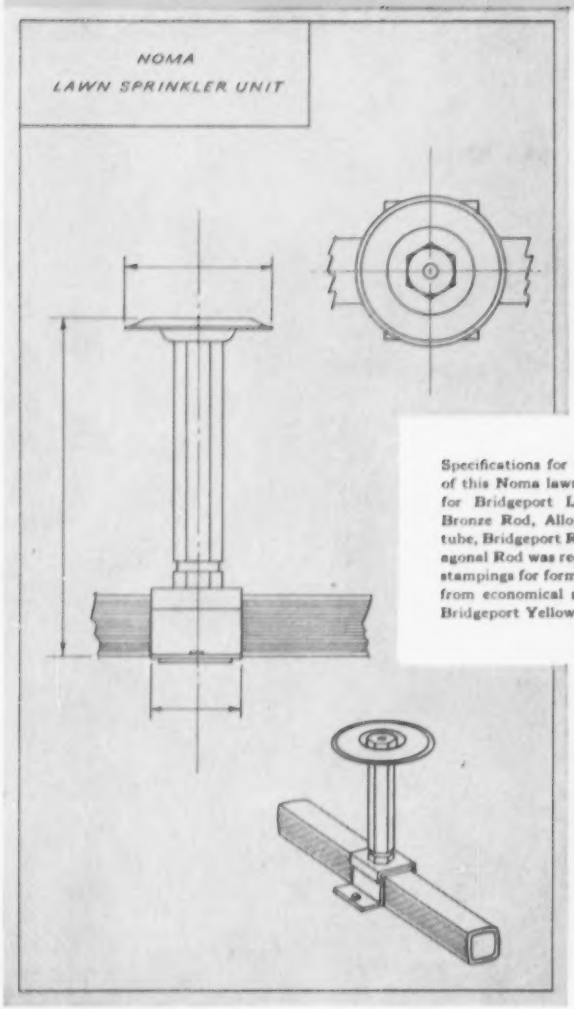
ACCURACY
UNIVERSAL APPLICATION
EASE OF OPERATION
the requirements of the times

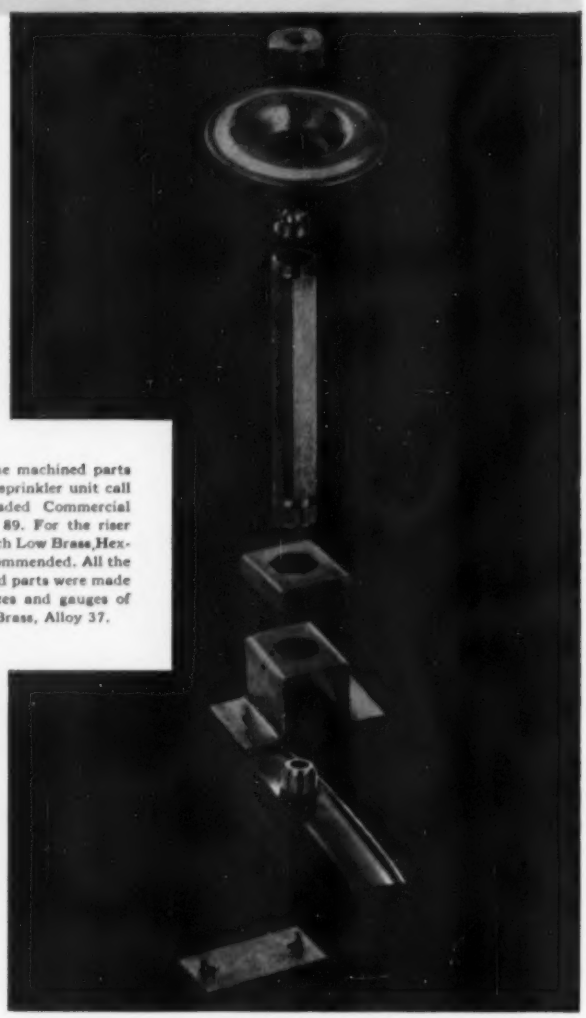
LORENZ

MASCHINENFABRIK LORENZ AKTIENGESELLSCHAFT
ETTLINGEN-BADEN · GERMANY

Matching metal to job with Bridgeport alloys



Specifications for the machined parts of this Noma lawn sprinkler unit call for Bridgeport Leaded Commercial Bronze Rod, Alloy 89. For the riser tube, Bridgeport Rich Low Brass Hexagonal Rod was recommended. All the stampings for formed parts were made from economical sizes and gauges of Bridgeport Yellow Brass, Alloy 37.



Photos courtesy Noma Spray Division, Noma Lites, Inc.

Whether it's machined or formed—there's a Bridgeport HIGH I.Q.* Alloy to match the job!

Producing a lawn sprinkler unit such as this requires a variety of metalworking operations. Bridgeport High I.Q.* alloys can meet all the requirements of your operations because they are job-matched to each production step. Whether your products involve one or many components, you can profit by using Bridgeport alloys. Your nearest Bridgeport sales office will be glad to help you select the alloys best suited for your particular job.

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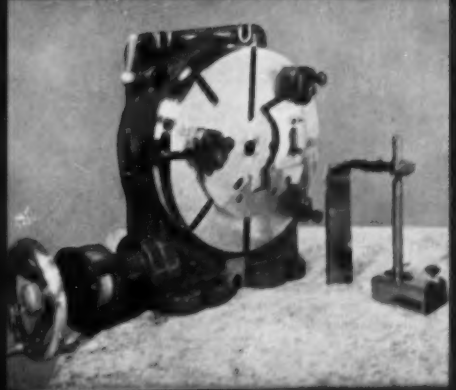
Presents a Rotary Table Accurate to ±3 sec. in 360°

(USING CHART)

Packaged for protection and convenience

NO. 2 MOORE 11-INCH ROTARY TABLE



Accurate in horizontal or vertical position

The following accuracy built for shop use:

All points in 90° increments, from 0, ±1½ sec.
All points in 18° increments, from 0, ±2 sec.
All points in 2° increments, from 0, ±4 sec.

Worm accuracy, ±1 sec.
Repetition of settings, ±1 sec.
4 sec. = .0001" on 10" dia.

Write for 8-page, 4-color brochure, of which this is the front cover.

Moore Special Tool Company, Bridgeport 7, Conn.

Builder of the Jig Borer and Jig Grinder

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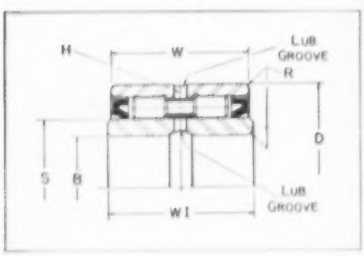
CAGELESS BEARING CORRECTS SKEWING

Guiderol Bearings carry greater loads in smaller spaces because they have no space wasting cages. A full complement of center grooved rollers extends the width of the race for maximum load support and a center guide rail avoids roller skewing that can bind a bearing under some loads. MT and CT series interchange dimensionally with ordinary needle bearings and cylindrical roller bearings.

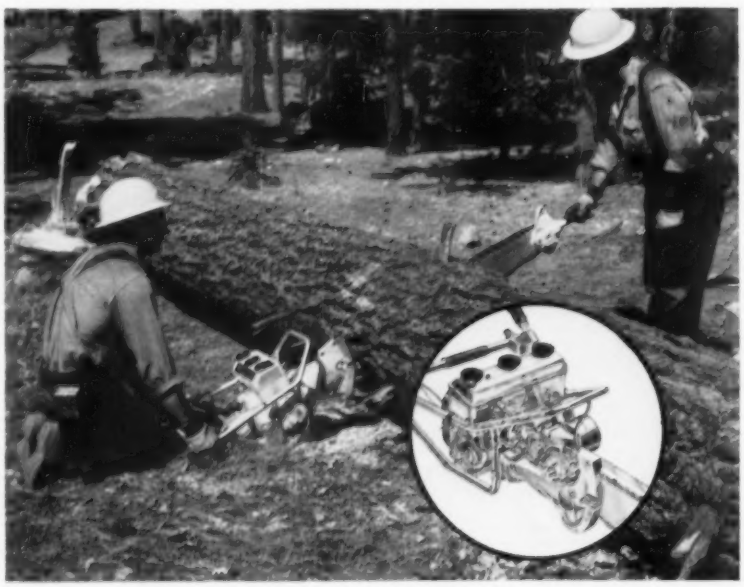
First Sealed Full Type Roller Bearing Series

The SG series Guiderol bearing provides low-cost and flexible sealing where ordinary needle-type bearings with auxiliary seals have been too cumbersome and expensive. Interchangeable with the standard Guiderol bearing, the new SG series provides five sealing combinations.



140 Pages of Bearing Facts

Write for your copy of Catalog No. 52, a revised 140-page Bearing Selection Guide. It contains vital product information and 50 pages of engineering data.



GUIDEROL® BEARING CARRIES GREATER LOAD IN SMALL SPACE FOR McCULLOCH CHAIN SAWS

Bearings installed in 1944 still in use.

Load-carrying capacity in minimum space is given as the reason for using McGill Guiderol bearings on the heavy-duty loader made by the Farmhand Company. Four bearings support the shafts of the gear pump that furnishes hydraulic power to the loader. Guiderol bearings have been used by Farmhand since 1944 and virtually all of the loaders with the original bearings are still in use.

Assembly ease cited as an extra benefit

Rugged use in the field dictates rugged construction at the factory for McCulloch Motors Corporation gasoline engine chain saw units. The one-man and two-man chain saws must be light and compact but sturdy enough to operate at full capacity all day long.

Since switching to a McGill Guiderol Bearing as support for the crankshaft, McCulloch, like many machine builders, has proved that the Guiderol bearing provides the desired greater load capacity in small space and outlasts former units with minimum maintenance—important under rugged chain saw field conditions.

A bonus benefit is the ease of installation of the Guiderol bearing—with open ends and no end shoulders. Assembly is a simpler operation.

Insure performance with McGILL®

MULTIROL® GUIDEROL® CAMROL
Full Type Roller Bearings

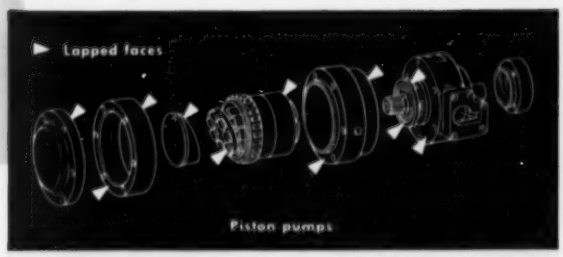
McGILL MANUFACTURING COMPANY, INC., 300 N. LAFAYETTE ST., VALPARAISO, INDIANA

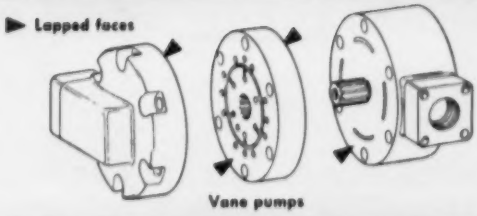
How Pump Manufacturers Use the

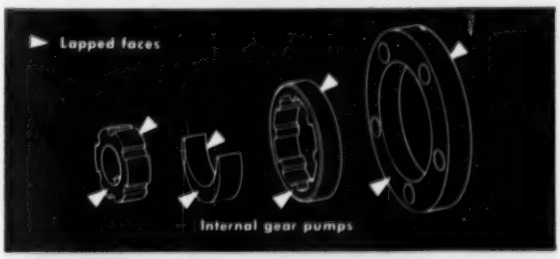
Lapmaster® To Improve Product Performance

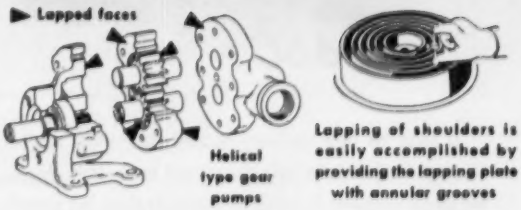
Like valve manufacturers, a large number of pump manufacturers need precision flatness and finish in order to insure efficient product performance. They're getting *both* flatness and finish plus parallelity in production quantities with Lapmasters. Photos at right illustrate a few typical parts being machined daily.

The high production accuracy of the Lapmaster (micro-inch finishes of 2 to 3 RMS—surface flatness to less than .000011" when required) is being achieved on all materials including cast iron, steel, stainless steel, magnesium, aluminum, brass, carbon, ceramics, plastics and sintered metals. It will pay you to investigate this modern precision, yet economical, method of machining.

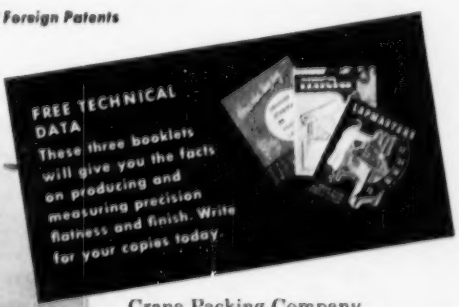







Lapped faces
Helical type gear pumps
Lapping of shoulders is easily accomplished by providing the lapping plate with annular grooves

*Protected by U.S. and Foreign Patents


FREE TECHNICAL DATA
These three booklets will give you the facts on producing and measuring precision flatness and finish. Write for your copies today.

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It takes the right machinery to build your product right! Columbus Die-Tool individually designs and builds tools, dies, and special machinery to produce your product alone. This gives you the advantages of lower operating cost, greater production and a higher quality product.

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SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

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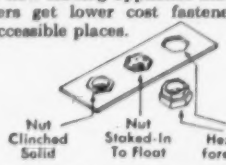
with the exclusive
hex on hex
feature

for "fixed" fastenings for "hard-to-reach" or blind assemblies. They wear longer, hold tighter, give greater customer satisfaction.

See how leading appliance manufacturers get lower cost fasteners into inaccessible places.



Gripco Clinch Nuts can be either clinched solid for a rigid application or staked in with a six point staking punch to give a floating effect. This floating effect takes care of misalignment and makes the application of the bolt easier. Gripco clinch nuts can be clinched or staked with stationary or portable hydraulic or air equipment. Details on request. Write for samples and data sheet.

Typical Applications

Automatic Washer for leg leveling and crating on all appliances

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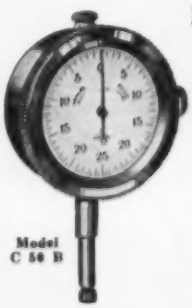

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are accurate, reliable and built to stand hard usage.

Model "C 50 B" has a 2½" overall diameter, balanced dial 0-25-0 with .0005" graduations, ¼" range and movable dial easily set at zero.

The cases on all R. & S. Gauges are made from sturdy castings. The case and plate are two separate units so that repairs can be made easily.

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cut it with stop

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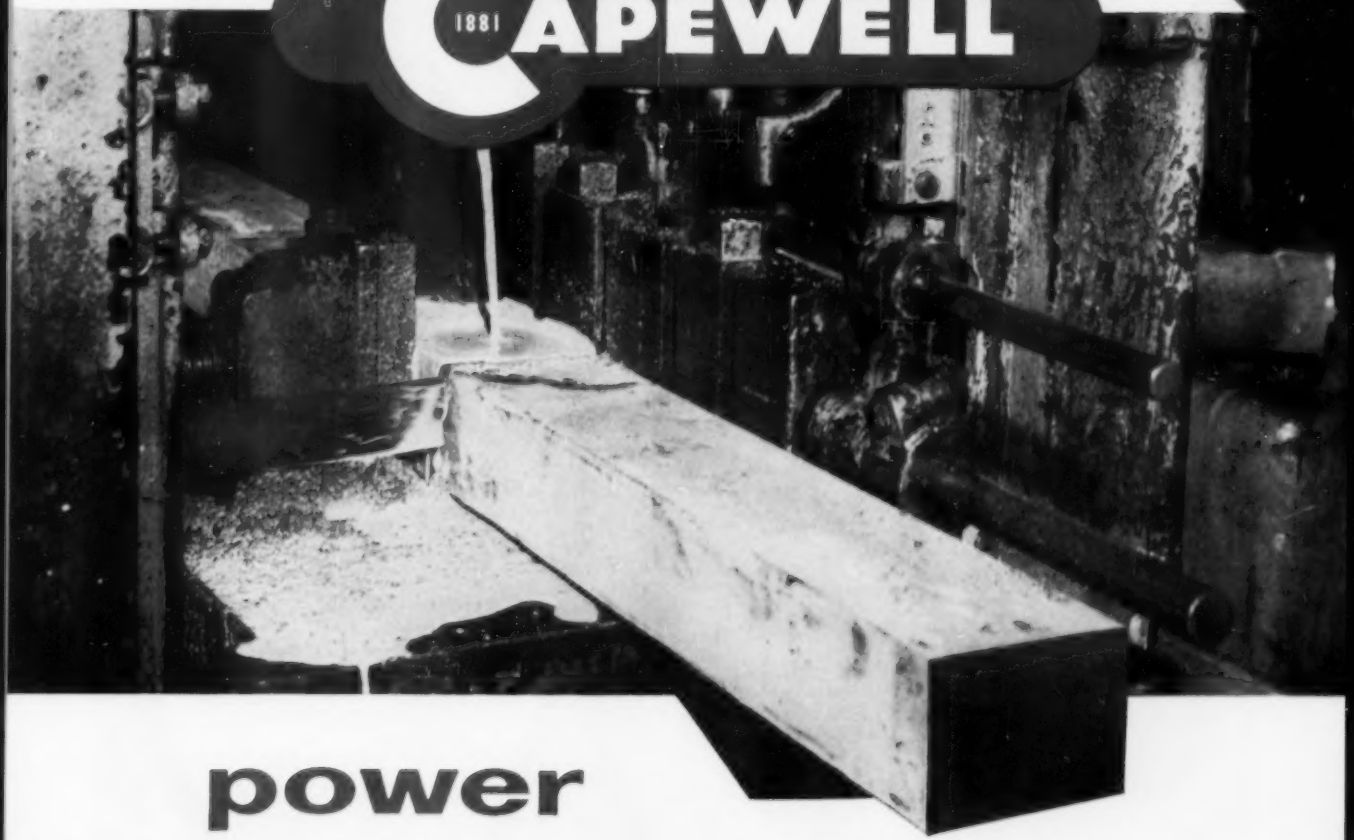

power hack saw blades

THE USER: Wheelock, Lovejoy & Co., Inc., Cleveland Plant.
THE MATERIAL: Alloy Steel Billets.
THE JOB: Maintaining normal production line speeds.
THE PROBLEM: Power hack sawing creating production bottleneck.
THE ANSWER: Capewell Safetech Power Hack Saw Blades.
THE RESULT: Power hack sawing now a routine operation—no more production headaches.

Wheelock, Lovejoy chose Capewell's shatterproof Safetech blade for this long, heavy job because they could get more cuts per blade, quickly and economically under heavy feed, while providing complete operator safety. Other Capewell power hack saw blades are Technite and High Speed—each of these all-hard blades is designed to give proved maximum sawing performance.

You, too, can improve your production by standardizing on Capewell Power Hack Saw Blades. Tooth by tooth, you'll find that Capewell blades are a superior product, manufactured to rigid specifications, so that you can be assured of blades that stay sharper longer.

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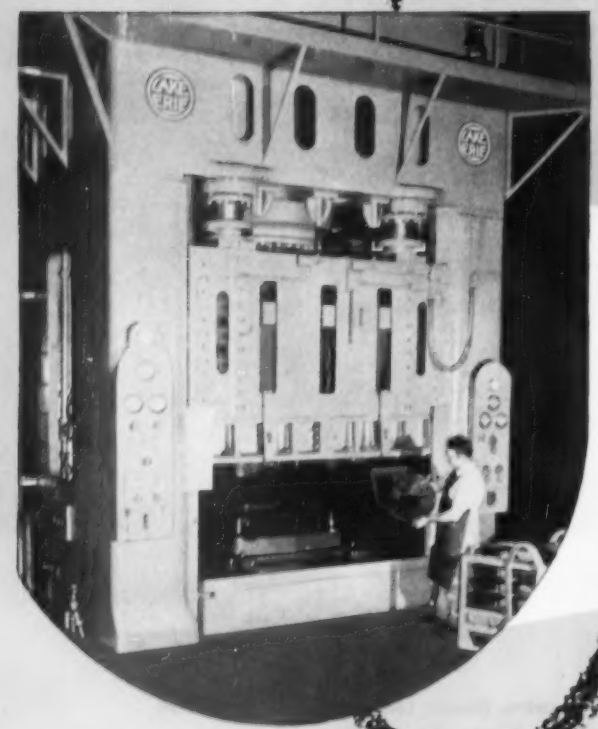
REPEAT ORDERS TELL THE STORY

of Customer Satisfaction with Lake Erie



One of the many different types and sizes of Lake Erie presses serving Caterpillar Tractor Co. is this 2,000 ton double action, side housing design with cushion. This press has a 42" draw stroke, 24" clamp stroke, 96" x 96" bed, closing and return speed of 430"/min., and pressing speed of 25"/min.

CATERPILLAR TRACTOR CO.

has re-ordered Lake Erie presses more than **20 TIMES**

Caterpillar Tractor Co. placed its first order for a hydraulic press in 1947. Today, some of the most important production operations in Caterpillar's plants are performed on Lake Erie presses. These operations include drawing, blanking, hot forming, bending, bulldozing and others. Like Caterpillar Tractor Co., many other of the great names in American industry use Lake Erie presses for a multiplicity of production jobs.

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No. 3-36 . . . 36" table travel . . . 42" x 12" table . . . full automatic hydraulic feed.

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HYDRAULIC MILLING MACHINE

Now—the family of Kent-Owens Milling Machines has expanded to give you the same unexcelled milling accuracy, speed and dependability for *larger size work!*

Proudly we present the No. 3-36 Hydraulic Milling Machine . . . the new "big brother" in the line of popular Kent-Owens Millers. Each Kent-Owens machine is ruggedly designed with advanced features throughout for greater dependability and accuracy to maintain tough production schedules. Write for bulletin 955 on wide range of hydraulic and hand-operated machines. Also, let Kent-Owens design and build your tooling and special machines.

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Simple . . . Rugged . . . Efficient

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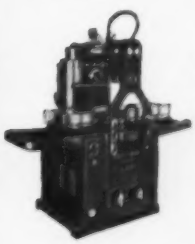
No. 1-14 . . . 14" table travel . . . 32" x 9" table . . . hydraulic table feed . . . full automatic cycle.



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No. 1-M . . . Hand feed to table and head . . . 25" x 9" table . . . 12" table travel . . . head counter-balance is adjustable.

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.0005 HOLE LOCATION IN 3 MINUTES

YOU NEED THIS TOOL EVERY TIME YOU USE A DRILL CHUCK or BORING HEAD in a VERTICAL MILL, HORIZONTAL MILL or JIG BORER, if the hole is located from a surface that has been machined.

$10.00
With Case

A well known aircraft manufacturer has more than 100 of these edge finders.

This edge finder rotates in the machine spindle from 360 to 1200 R.P.M. and it is held in a ⅜" collet or end mill holder.

- NO DOUBT WHEN LOCATION IS REACHED—The lower half jumps sideways 1/64" and continues to rotate there when location is reached. This occurs at the same dial graduation every time.
- NO EYESTRAIN—Location can be seen easily with average light. A source of light is not needed behind this edge finder.
- SHORT DISTANCE REQUIRED FROM WORK TO MACHINE SPINDLE—This edge finder permits the use of short tools without readjusting the machine because its length is only 2½".
- LOCATES FROM FLAT OR ROUND SURFACE.
- LOCATES FROM STEP ONLY .010" HIGH.
- IDEAL TOOL for LOCATING HOLES in DRILL JIGS, DIES, TOOLS and MACHINE PARTS.
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- MADE FROM HARDENED TOOL STEEL WITH ALL SURFACES GROUND.

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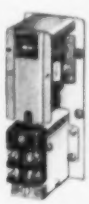
What TIMING RELAYS were most popular at the Chicago Machine Tool Show?

ALLEN-BRADLEY!
51.7% of all timers used were A-B

At the recent Chicago Machine Tool Show, more Allen-Bradley pneumatic timing relays were incorporated in the design of special control panels than all other makes combined —according to a survey of 849 machines. Furthermore, Allen-Bradley led in motor starters, relays, and disconnect switches, too!

Machinery manufacturers prefer Allen-Bradley motor controls because they are long lived . . . consistent in action . . . and above all else, trouble free in operation.

Bulletin 849 Pneumatic Timing Relay—the favorite of machine tool manufacturers because it is consistent and reliable in operation!



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Featuring all the Ruggedness, Dependability and Consistency of Operation Common to Sciaky Basic Thinking—Welders Designed to Do More Useful Work at Lower Operating Cost with Maximum Reliability!

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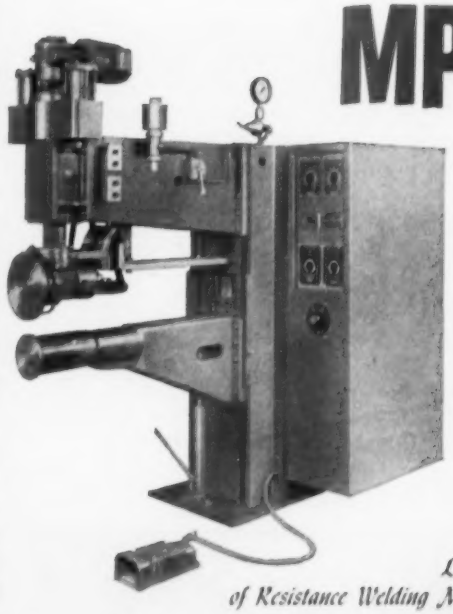

Through advanced design, volume production tooling and complete use of integrated parts, Sciaky has been able to add a seam welder to its line of competitively priced, small, standard welders. Check these important design features . . .

Pneumatic Double-Acting Cylinder Head
Low Inertia, Anti-Friction Bearing Guided Ram
Side Mounted Sciaky Integral Control
Low Impedance Secondary Circuit
Sciaky High Efficiency Welding Transformer
Copper Alloy, Fully Adjustable Lower Arm
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For complete details and specifications on the MP-2 seam welder write for Bulletin 321-7.

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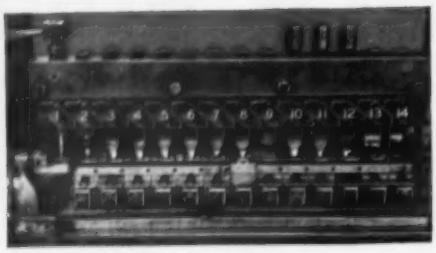
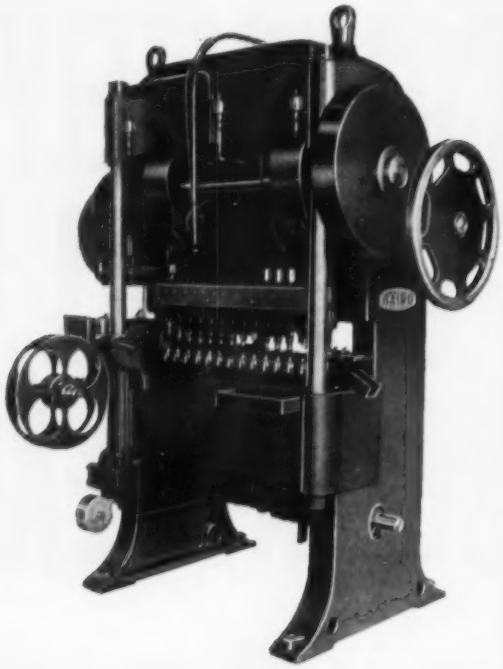
...ask BAIRD about it



A complete die set with full compliment of punches and dies in working position and with transfer in loading position. Note accessibility of all mechanisms and adjustments.



What is so different about BAIRD Multiple Transfer Presses

Many still confuse these advanced high production machines with multiple-slide presses (commonly called eyelet machines) or with equipment using progressive dies.

They are, in fact, entirely different . . . and the advantages of Baird design result in much more flexible and versatile tooling . . . much less down-time for initial tooling, maintenance and change-over . . . use of minimum width stock . . . maximum production speeds smoothly maintained.

In addition, Baird Multiple Transfer Presses can maintain closer tolerances than previous methods on high production of parts requiring from 8 to 15 consecutive operations.

So smoothly do these machines operate that old-time press-room clatter is a thing of the past. Normally, long production runs at high speed may be maintained without adjustment down-time.

If you are looking for the most modern equipment available for volume production of press-produced parts . . . by all means "ask Baird about it." Our development of the Baird Automatic Multiple Transfer Press has set many new standards in this field. Write Dept. AM.

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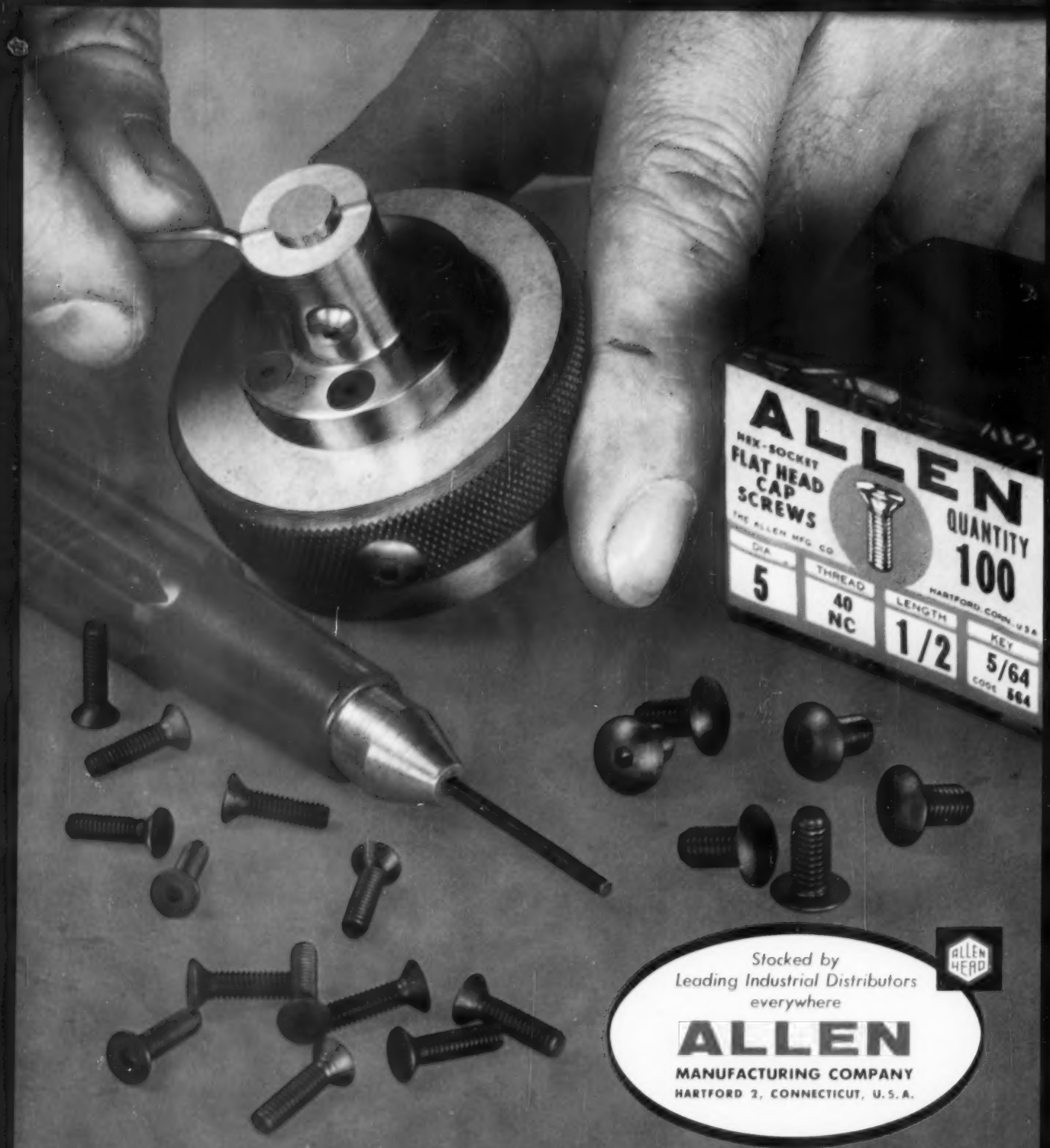

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A MESSAGE TO AMERICAN INDUSTRY • FIRST OF A SPECIAL SERIES

THE SHORTAGE OF SCIENTISTS AND ENGINEERS: *How Critical Is It?*

The United States is running into a serious shortage of scientists and engineers. There is no novelty in this observation. It has often been made in the last few years. And there has been mounting alarm about what this shortage may mean for both our national security and our prosperity.

There would be great novelty, however, if general agreement were attained on such important matters as the size of the shortage, the extent of the damage it threatens to inflict, and the best ways to eliminate it. The purpose of these editorials is not to provide this novelty, but to ventilate some of the key aspects of the shortage of scientists and engineers.

This first editorial in the series is designed to throw light on the over-all dimensions of the shortage. Others will be addressed to such questions as:

- How serious is the threat to our economic well-being and to our national security?
- What needs to be done to prevent the shortage from becoming critical?

Rise in Technical Manpower Has Been Rapid

The problem is *not* that we have been producing a small number of engineers and scientists. Indeed, the number has risen sharply. We now have a working force of more than 600,000 engineers, over twice as many as the 286,000 there were in 1940. And we have about 250,000 scientists (chemists, physicists, biologists, geologists, mathematicians, etc.), compared to only 92,000 in 1940. About one in 148 persons in the labor force of 1940 was a scientist or engineer; today the ratio is about one in every 80.

In research and development work, where highly creative scientific minds are required, there has been fully as rapid a rise in employment of scientists and engineers. Fewer than 90,000 were employed in research and development fifteen years ago; the total now exceeds 200,000.

. . . But Not Rapid Enough

Despite this rapid increase in the number of scientists and engineers—at a rate much faster than the increase in the labor force as a whole—the needs of industry, government and education for technically trained people have risen even more sharply.

The principal reason for this mounting demand is the prodigious growth of research in the last 15 years. From a total of only about $900 million spent on all types of research in 1941, the annual expenditure rose to over $5 billion by 1953 (the latest estimate available). Over two-thirds of the research is done by private industry, mostly to develop new and better products and to find new and better methods of production. Most of the rest is performed by the government, largely to develop improved and inevitably more complex scientific weapons.

One aircraft company has found from its own experience that it required 17,000 engineering manhours to develop a typical fighter plane in 1940. The requirement is now about 1.4 million engineering manhours. Development of the typical fighter plane of 1960 will require well over 2 million engineering manhours.

In this dramatic example, the need for engineering services for a basic piece of military equipment soared 80 times in 15 years. It is an indication

of why the demand for more and more technically trained men and women has outstripped even the imposing increase in scientific and engineering manpower of the last decade and a half.

Size of the Shortage

Exactly how great the gap is between the available supply of scientists and engineers and the number required, it is impossible to say. In some instances technical talent undoubtedly could be better used than it is now. And part of the shortage might "disappear" if higher salaries had to be paid. (These questions will be discussed in later editorials.) But informed estimates of the approximate size of the gap can be given.

● According to the best available information, from estimates by the Engineers' Joint Council and the U. S. Bureau of Labor Statistics, **the minimum need for engineers from graduating classes is 40,000 each year for the next ten years.** Last year we graduated only 23,000 engineers, just about enough to cover replacement needs without allowing for any expansion of the number of active engineers. Projections made by the U. S. Office of Education indicate that we shall probably not have a class of 40,000 – the *current* annual requirement – until 1963.

● According to Dr. Howard Meyerhoff, executive director of the Scientific Manpower Commission, **there is now a shortage of about 20,000 scientists.** Last year the number of doctoral degrees in the natural sciences, almost a prerequisite for research work, was only 5,000. Dr. Meyerhoff estimates that the shortage of scientists will rise another 30,000 by 1960.

More Needed as Teachers

Not all of the graduates with scientific and engineering training, furthermore, will work as scientists and engineers – that is, by performing research and giving it practical application. Such training is now necessary in many sales and management positions. And more of our technically trained men and women must remain in educational institutions as teachers if the quality of engineering and scientific education is to be maintained. A survey in 1954-55 by the National Education Association showed that, out of 277 universities, state colleges and large private colleges, nearly one-third *already* had unfilled vacancies in engineering and three-fourths had vacancies in physical sciences.

The dimensions of the shortage of scientists and engineers can be summarized as follows: **Despite a substantial rise in the trained manpower available, the needs of industry, the government and education have risen still faster. The best information indicates that, on the basis of current and anticipated needs, our recent yearly rates of production of slightly over 20,000 engineers and about 5,000 PhD's in natural sciences could be doubled without closing the gap entirely.**

The disturbing implications of this shortage for our national security and our prosperity and some practical suggestions for eliminating it will be the subjects of subsequent editorials in this series.

This is one of a series of editorials prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments of particular concern to the business and professional community served by our industrial and technical publications.

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Donald C. McGraw

PRESIDENT

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Three interchangeable dials and three sets of burners permit any operator—without previous set-up experience—to handle both simple and complex assemblies. This versatile machine was designed to automatically silver-braze several sizes and shapes of fittings to $\frac{5}{8}$" diameter brass tube, ranging from less than 4" to more than 14" in length.

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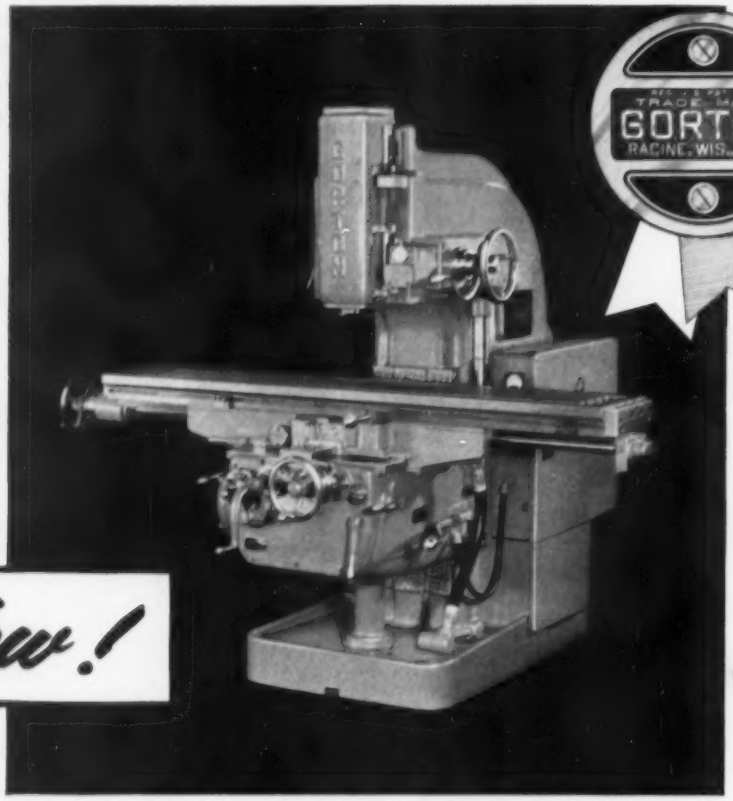

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- Designed for high-speed and carbide milling
- 76-inch table; 48-inch table travel
- 46-inch saddle with hardened wear plates at each end
- 24½-inch Fullwidth knee
- 15/7½ H.P. spindle motor — drives spindle only
- 5 H.P. feed motor
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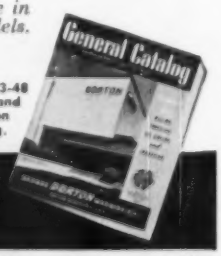
- 3 Feed Ranges available
- Square-Lock bearing guides with long length-to-width ratio
- Dial-type horsepower load meter
- Interchangeable Assembly unit construction
- 100% mechanical and electrical overload protection
- Removable coolant pan for easy clean-out

Above features also available in Horizontal and Universal models.

Write for Catalog 2585, which describes 3-48 Vertical Mills, and 1500 1655 Gorton General Catalog.



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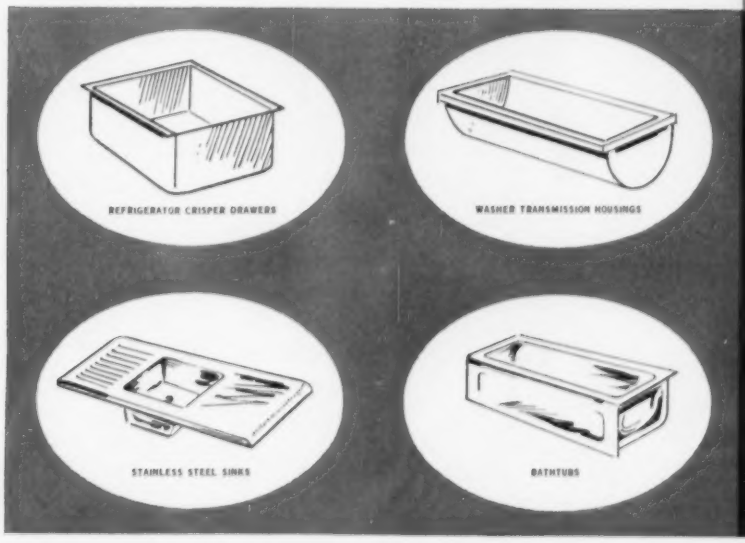
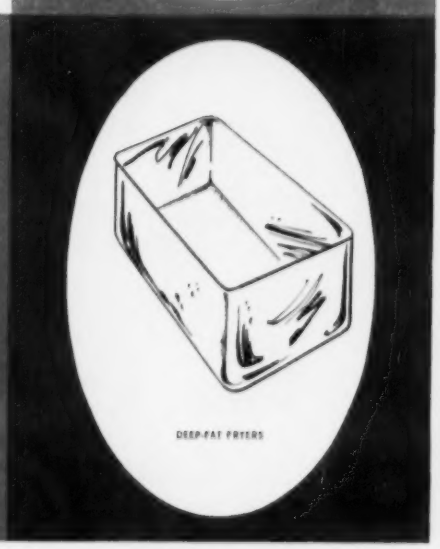
Cut your deep-draw reject rate!

How?

With Pennsalt **DRAWCOTE!**





You can keep deep-drawing dies in top working condition, and cut rejects to a startling degree—simply by using steel bar and sheet stock *pre-coated* with Pennsalt DRAWCOTE. A dry, homogeneous lubricating film applied either alone or in conjunction with other Pennsalt FOS Process chemicals, Drawcote gives even severely-drawn pieces a welcome freedom from scratches and galls . . . protects dies longer than old-fashioned wet lubricants . . . cleans off easily *at any time* before finishing.

There's a Pennsalt FOS lubrication system tailored to improve *your* toughest deep-draw operation—on parts ranging from thin sections to heavy housings . . . aluminum to stainless steel. Whether your job calls for Pennsalt FOSCOAT®, FOSLUBE®, DRAWCOTE®, or any combination of these FOS lubricants, they're applied before the metal comes to the drawing presses —in fact, often by the supplier of metal stock. Parts generally need no recoating between press stages. Call your Pennsalt man for the whole story, or write Metal Processing Dept. 332, Pennsylvania Salt Manufacturing Co. East: Three Penn Center Plaza, Phila. 2, Pa.; West: 2020 Milvia St., Berkeley 4, Calif. In Canada: Pennsalt Chemicals of Canada, Hamilton, Ontario.

FOR EXAMPLE:

One manufacturer of deep-fat fryers and other severely-drawn appliance shells tried all the old drawing compounds he could lay his hands on—soaps, oils, waxes—but the shells still came out scratched and needed costly buffing before going to the plating line. Since trying one of the Pennsalt FOS cycles designed for his lubrication problem, he's discarded the wet, messy, unpredictable drawing compounds of the past . . . started turning out scratch-free parts . . . has lowered costs in dies, raw materials, finishing . . . made his shop a cleaner, happier place to work in.

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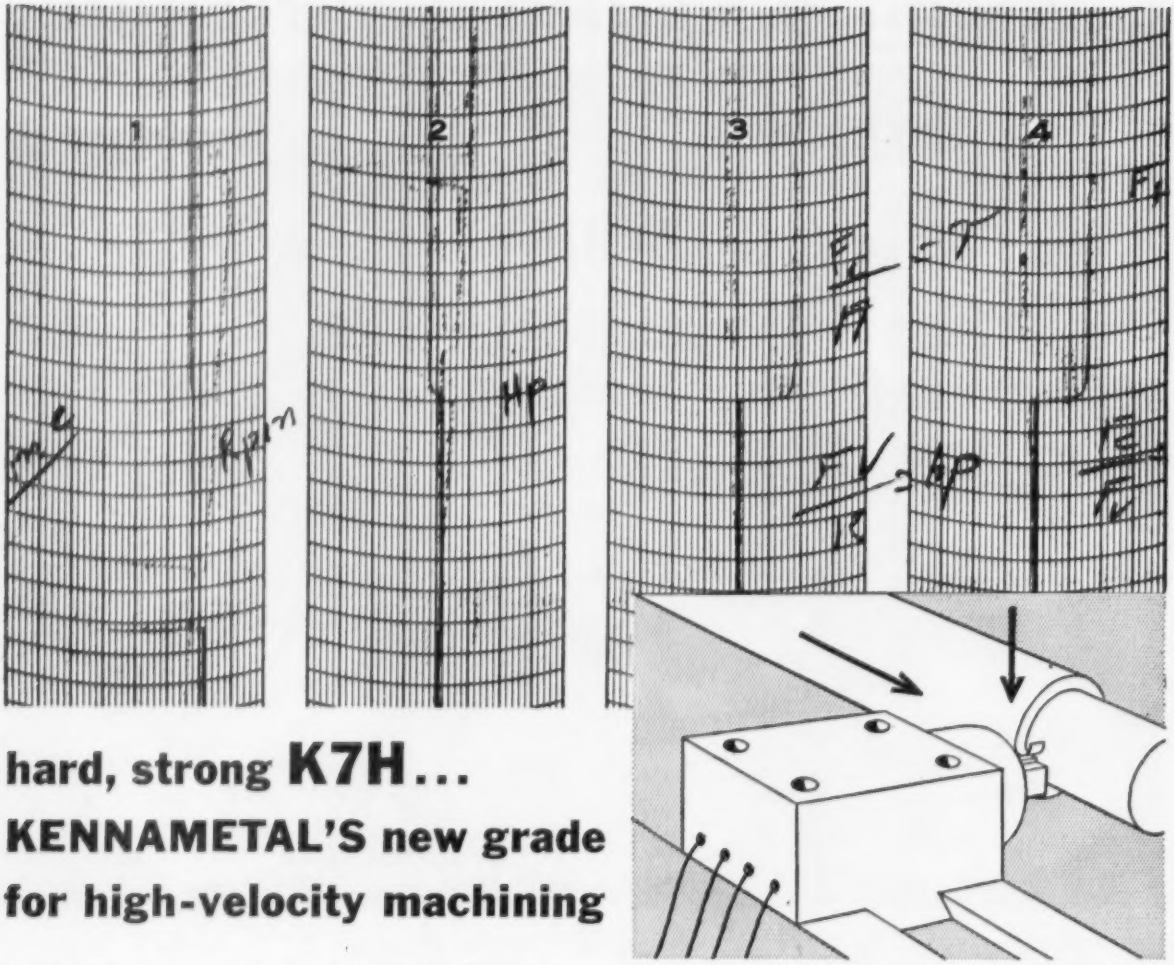

hard, strong K7H... KENNAMETAL'S new grade for high-velocity machining

In lab and shop tests, Kennametal* Grade K7H has proved to be a real "work horse" for high-velocity machining.

It's a genuine carbide—the hardest ever offered by Kennametal (93.5 Rockwell A).

It's strong—two to three times the strength of non metallic cutting materials . . . strength to resist chipping and cratering . . . strength to trace and cut to a shoulder . . . strength to stand up to normal shop abuse without "babying."

It's versatile . . . has the stamina to cover the range of feeds and depths of cuts for modern high-velocity finishing of steel alloys and the new hard-to-cut materials. Grade K7H even takes casting "skin" and forging scale in stride on light cutting—another indication of its strength and stamina.

In the Lab—with tool post dynamometer:

Compared with other carbides at high velocity, Grade K7H showed these results: *Test No. 1* (without coolant) —K7H performance, cutting 29-32 Rockwell C steel, indicated 27 times longer life; *Test No. 2* (with coolant) —K7H showed 28 to 1 better performance (also on 29-32 Rockwell C materials) than the control carbide grade; *Test No. 3* (without coolant)—cutting 37-39 Rockwell C steel, Grade K7H showed considerably higher resistance to wear than other carbides.

In the Shop—production runs:

Compared with non metallics, and long-established carbides on high-velocity finish machining of SAE 5135 170-207 Bhn., Grade K7H averaged 1000 gears per cutting edge while other carbides produced only 350 pieces; and ceramics broke down at 400-450 per edge.

These tests show that Kennametal Grade K7H is truly the "work horse" for high-velocity machining as we know it today. Why not ask a Kennametal tool engineer to demonstrate Grade K7H in your operations. Or write for complete information. Address KENNAMETAL INC., Latrobe, Pennsylvania.

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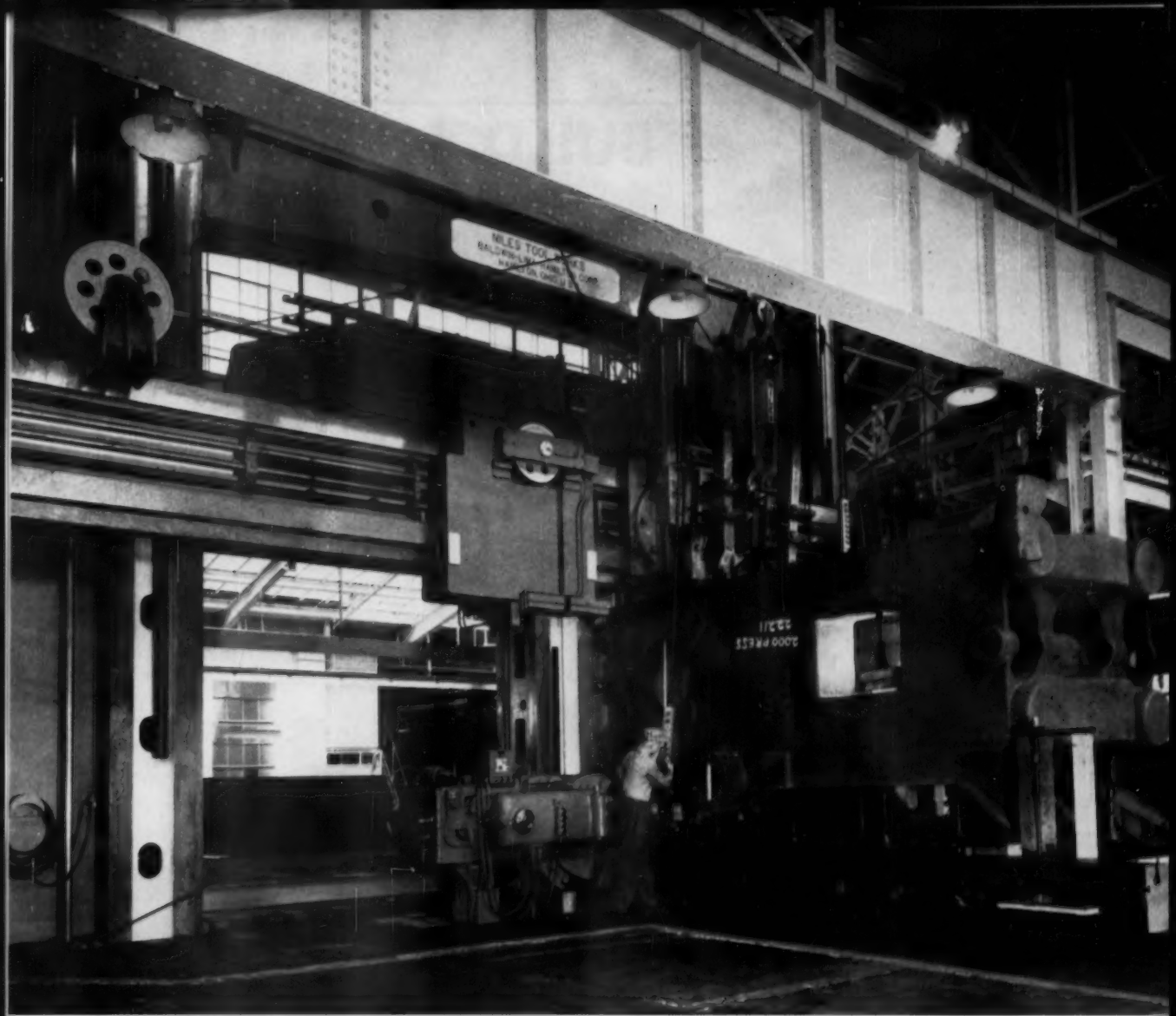

At National Machinery

new Niles 23-ft. planer handles any casting that can be shipped by flatcar

With this new Niles 23-ft. planer, National Machinery Company—outstanding manufacturers of hot and cold forging machinery—has the answer to reducing over-all setup and machining time at their Tiffin, Ohio plant. They've found this huge machine combines the rigidity and accuracy of a double housing planer with the versatility of a convertible planer. It's being used chiefly to machine planed surfaces of beds for forging machines ranging up to 130 tons. With it they can plane—in one setup—any size casting that can be shipped by flatcar.

You, too, can profit from the unmatched engineering know-how, experience and facilities that back every Niles machine tool. Notable Niles achievements include the design and manufacture of some of the largest machine tools ever made . . . lathes with 10-ft. swings, boring mills with 43-ft. tables, planers with 23-ft. clearance between housings. Whether your jobs be big or small, you'll discover Niles tools operate at highest production speeds to meet heavy production demands . . . to give you top quality output at the lowest possible operating cost. For complete details on the Niles Tool family, write now to Dept. 9802, Hamilton Division, BLH Corporation, Hamilton, Ohio.

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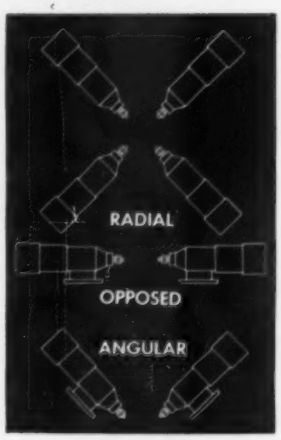

With Govro-Nelson Automatic Drilling and Tapping Units, together with the bases and electrical controls which we can supply, you can build yourself an automatic drilling or tapping machine at substantially lower cost than a special machine.

Any number of units may be employed. Examples of the various ways in which they may be arranged are shown at the right.

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The Drilling Units are made in several sizes with spindle speeds from 1100 to 3450 RPM. Drill Units have full Hydraulic Control with external adjustment for the rapid approach, the rate of feed and the length of stroke. Suitable for drills up to 3/8", depending on material.

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At Graflex, Inc., in Rochester, N.Y., operators inspect their own work and get paid for it, and foremen have full freedom of action. These are just two important characteristics of the organization of the camera and precision-equipment manufacturer bearing this familiar name.

This *American Machinist* Special Report by Executive Editor E. J. Tangerman describes production methods at Graflex in detail. Over fifty photographs and other illustrations add to the value of the twenty-page report.

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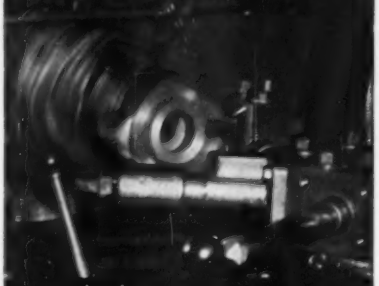

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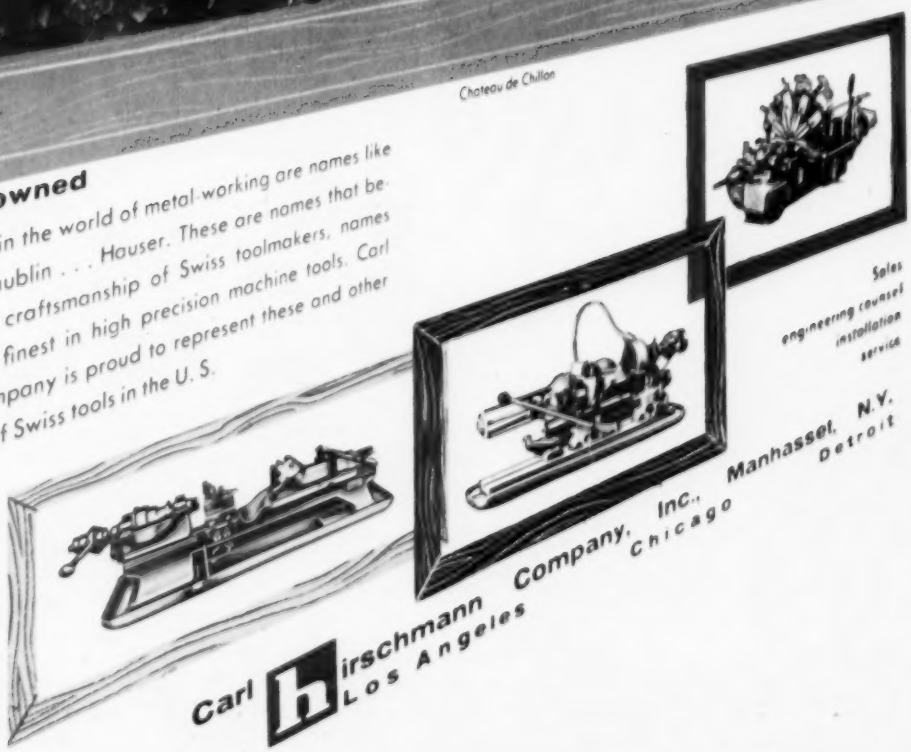

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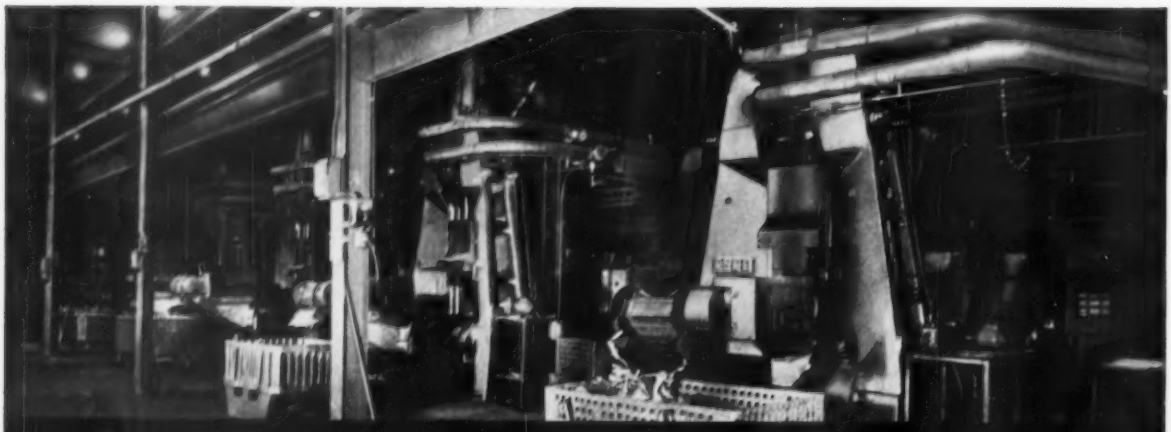
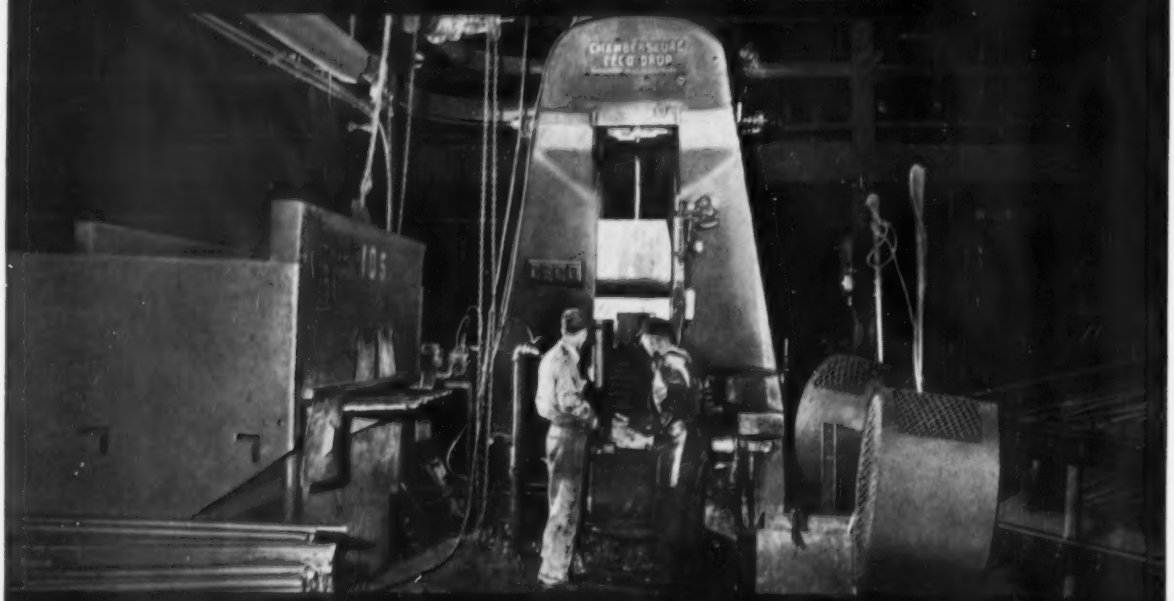


Four of six Ceco-Drops which replaced Board Hammers in a large automobile forge shop

·CECO-DROP·

The Ceco-Drop was selected because of better maintenance record and ease of operation



High production is maintained—there are no boards to change—fewer adjustments to make

·CECO-DROP·

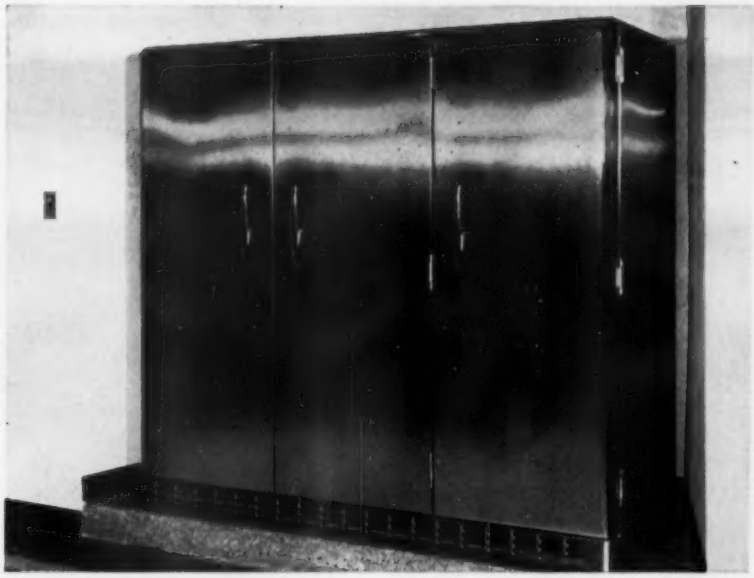
The Ceco-Drop is safer and easier to operate. "Leg fatigue" is eliminated. There are no overhead hazards

Parts shown here are typical Ceco-Drop forgings

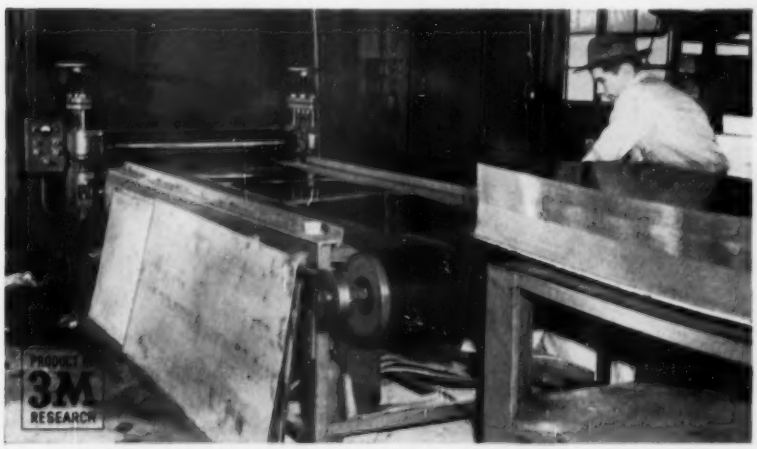
·CECO-DROP·

They are automobile shock absorber parts—pitman, anchor and arms

Have you the latest CECO-DROP bulletin? Write CHAMBERSBURG ENGINEERING COMPANY, Chambersburg, Pa.

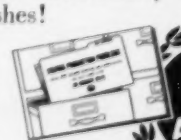


PROBLEM Victory Metal Mfg. Corp., maker of commercial refrigerators, uses coated abrasive belts to surface-polish 18-8 stainless steel sheet stock from its standard 2B mill finish to a #4 finish. With Brand "X" Belts, costs per polished sheet were high.



ANSWER A 3M Representative suggested that this Plymouth Meeting, Pa., firm switch to 3M Abrasive Belts — Grit #80 Three-M-ite Cloth for rough grinding, Grit #150 Tri-M-ite Resinite Cloth for polishing. Cost per sheet for polishing operations immediately dropped substantially, with superior finishes!

Your 3M Representative can help *you* cut costs and increase production, too. Call him today. Or write Minnesota Mining and Manufacturing Co., Dept. AM-56 St. Paul 6, Minn., for FREE booklet: "Case History Reports on 3M Abrasive Belts".



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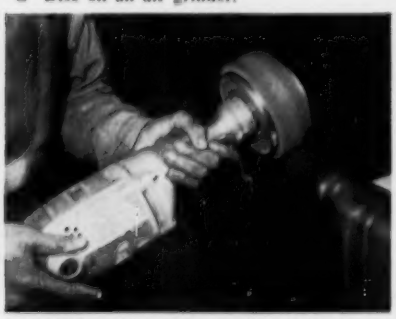
Look what 3M ABRASIVES *can do!*

INSIDE CORNER WELDS on refrigerator panels are quick-sanded smooth with a Three-M-ite "Evenrun" Band on a flexible shaft.

5" CORNER WELDS on the stainless steel doors are rough ground with a Grit #36, 3M Type "C" Disc on an air grinder.



THE SAME CORNER WELD is blended and polished with a Three-M-ite Cloth Clipped Belt on 3M's amazing "Quick-as-Wink" Wheel.

COMPLETE DOOR PANEL is hand-rubbed to a satin finish (similar to finest furniture) with Three-M-ite Cloth Sheets.

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1 *With the drill fixture clamped in alignment under the spindle, a higher level of quality can be maintained and repair work has dropped to a minimum.*

2 *Operator performs work with less fatigue.*

3 *The uniform hydraulic feed enables us to produce better finishes and size."*

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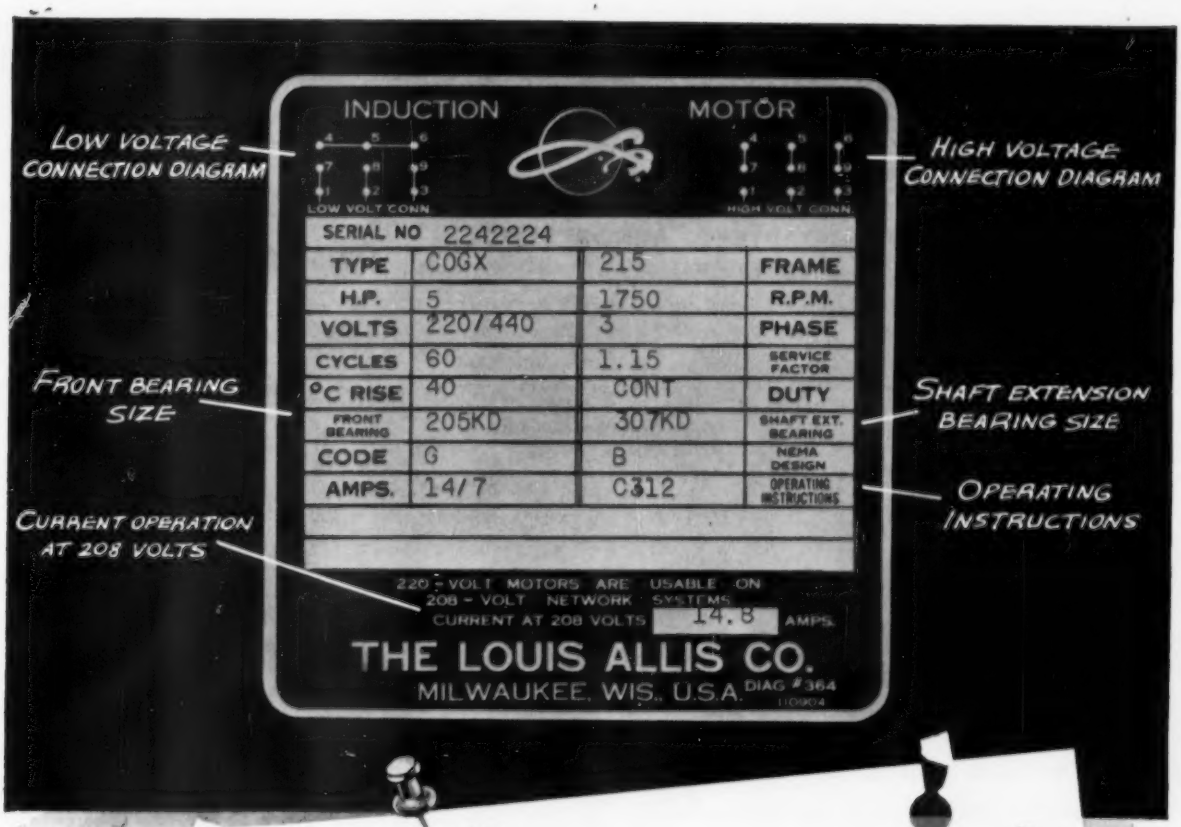
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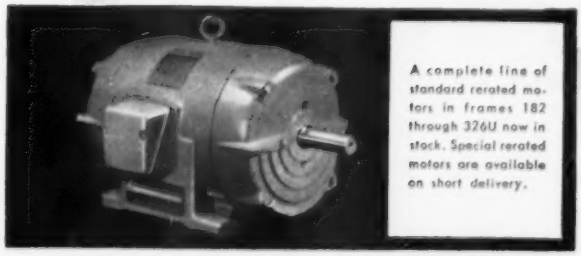

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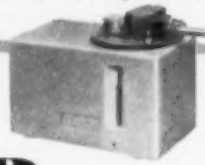

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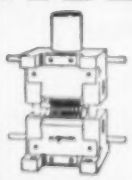

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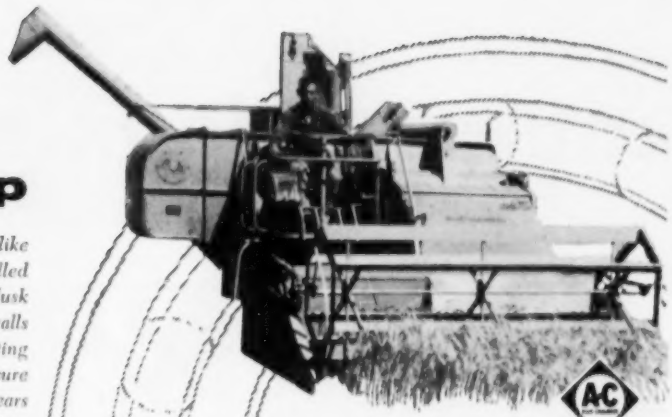

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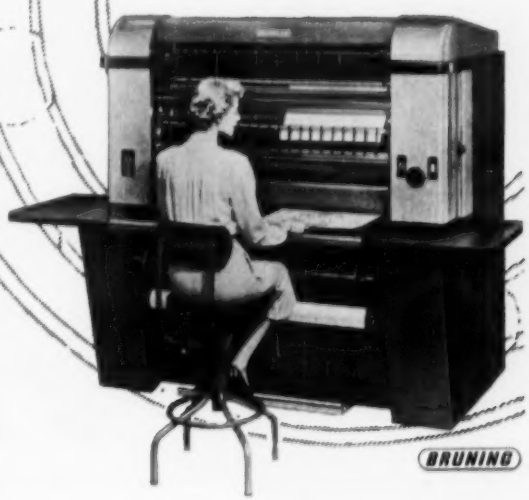

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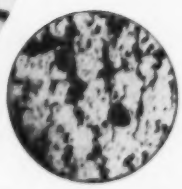

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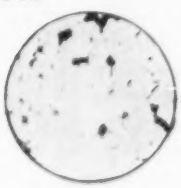

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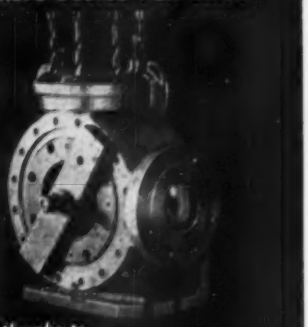

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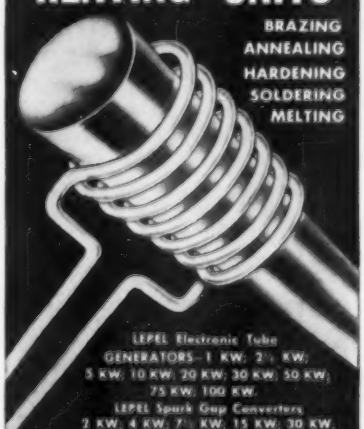

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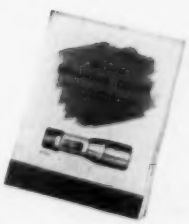

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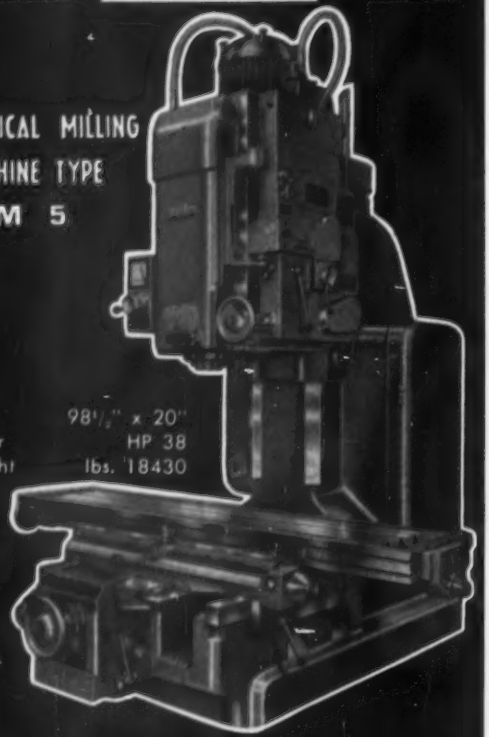

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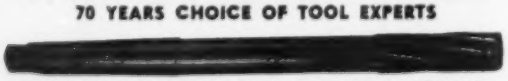

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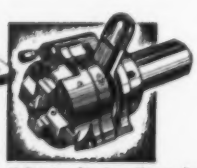

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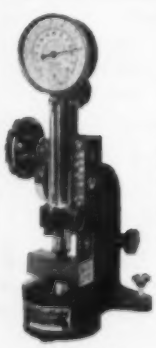

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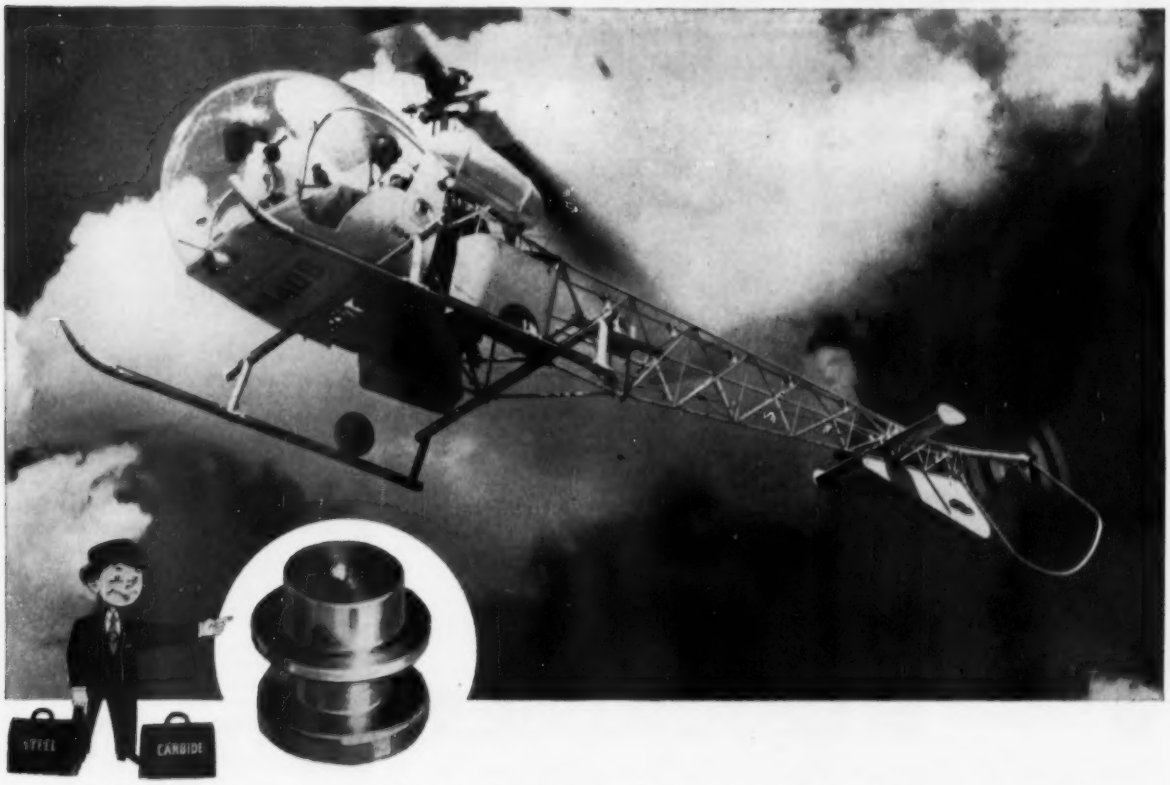

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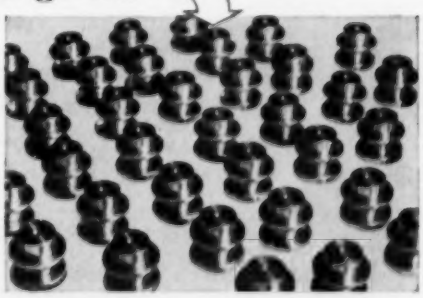

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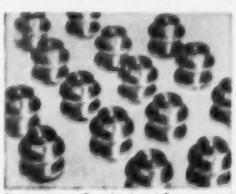

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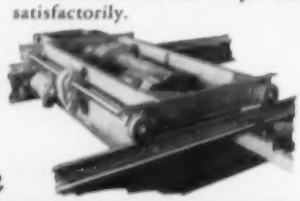

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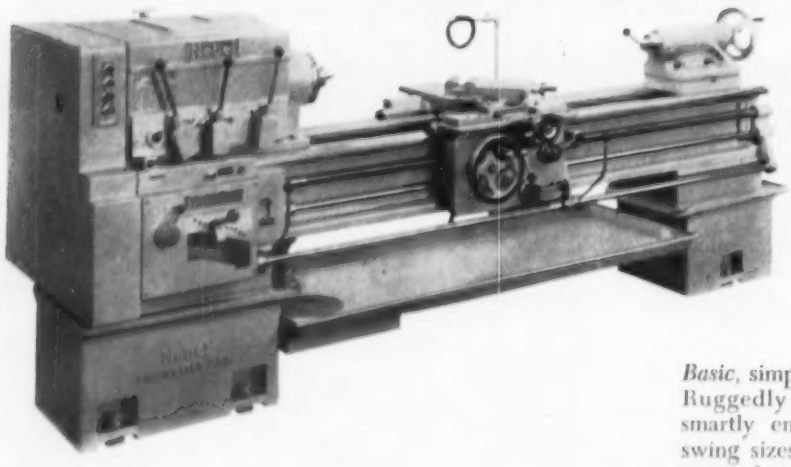

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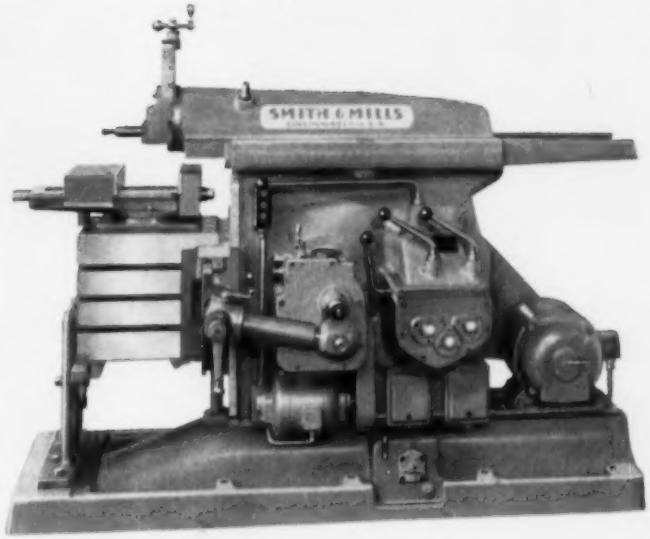

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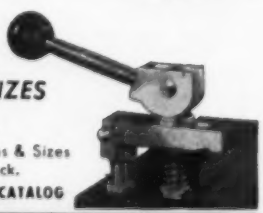

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the Surplus Machinery Market

"No real headaches even though business is off a little" since January and February is the consensus of reports from surplus machinery dealers across the country. But there is one notable exception—Detroit. Dealers in the Motor City report business is definitely off—anywhere from "just a little" to "considerable." The slowdown has showed up in buying from all types of metalworking industries, not just autos.

One Detroiter attributes the slowdown to buyers' layout of tax money. Another thinks the reason is the slowdown in auto output, but that the auto overstocks will be whittled down come summer, and passenger car output will tune up soon, with the used machinery business following suit. While Detroiters are optimistic that business will climb back up again soon, Detroit is naturally the first area to feel the auto cutback pinch, and dealers in other sections of the country would do well to keep their eyes on the surplus machinery market there, because sooner or later, if the auto output cutback continues, its effect will be felt deeply by a lot of industries in almost every metalworking center in the country. So far, it hasn't even penetrated into other sections of Michigan, where dealers report uniformly good business.

Demand for used machine tools in the "Machine Tool Desert" (that's what they used to call the South and Southwest) is growing tremendously these days—with Texas, Arizona and the Southeastern states flooding Eastern and Midwestern dealers with orders for production machines: although toolroom machines are moving slowly there.

Here's a real cutie: last year, a big Midwestern dealer spent several weeks in England and shipped back a lot of used US-made machine tools to this country. Some, that were shipped via New York, have already been sold. Others are enroute through the St Lawrence and the Great Lakes, and there'll be plenty of buyers waiting for them. Why? He says there's no comparison between a US-used machine tool and a British-used tool of the same vintage. That's because the British don't use them as hard, care for them like babies. His last year's trip was so successful, he'll do it again in June.

This may be one reason for the current high level of sales, as advanced by this same dealer: buyers today have a lot more confidence in the integrity of surplus machinery dealers than they did before World War II. Back then, it was hard to find a metalworking executive who had much confidence in the surplus dealer. Today, what with the yeoman work performed by the Machinery Dealers' National Association and local groups in improving the ethics and raising the standards of the industry, the metalworking executive has a lot of faith in the dealer's integrity and in the quality of the machines he sells.

Auctions are still for the birds these days as far as surplus machinery dealers are concerned, with most dealers not even bothering to go. You just can't compete with auction-happy direct buyers, who'd rather pay exorbitant prices for a pig-in-a-poke than reasonable prices for dealer-guaranteed machine tools.

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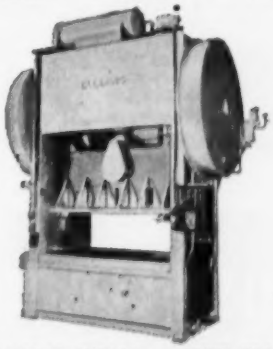

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Nos. 5 & 3 B. & O. '45
No. 3 Gisholt, Bar. Chuck, '42
MILLERS, Nos. 22L & 12 Van Normans
SHAPER, VERT., 12" Pratt & Whitney, 1942
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Gleason 3" Str. Bevel Gear Gen.
No. 3B K&T Plain Mill, MIB, 1925.
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16"/18½" x 10' MONARCH toolmakers Lathe, Model C-W 78" Centers. Full Equipment. Late Type.

4 DE POTTER & JOHNSON Automatic Turret Lathe. Late Type.

27"x18' MONARCH "N" Geared Head Lathe, 11' centers, Taper Attach., Full Equipment, Late Type, 1942.

24", 36" BULLARD Vertical Turret Lathe, Turret Hd. Side Hd., M.D.

No. 2, 4, 6 WARNER & SWASEY Univ. Turret Lathes, Bar Feed.

No. 2, 7 BARDONS & OLIVER Universal Turret Lathes, Preselector, Bar & Chucking. Late Type.

DRILLING MACHINES

6 Spindle No. 2 LMS LELAND-GIFFORD Drill Press. Late Type.

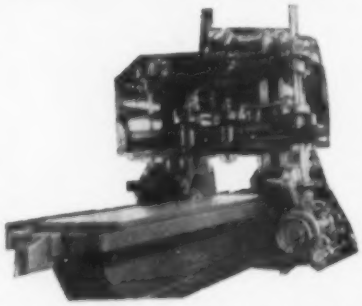
No. 2 M. T. Six Spindle ALLEN Type KH Drill Press, Individual Motor Drive, Late Type.

No. 18 MARVEL Hydraulic Roll Stroke Power Hack Saw, 18" x 18" cap., M.D.

No. 2 BROWN & SHARPE Vert. Mill, Light Type, Swivel Head, M.D., Late.

No. 28 BROWN & SHARPE Horizontal Mill. Motor in Base, Late Type.

1A PRATT & WHITNEY Jig Borer, with Gauges, rods, Collets and Chuck.



42" by 36" x 12" INGERSOLL Planer type mill, two heads on rail, two side heads M.D.

No. 91-C TOLEDO Straight Side Double Crank Power Press, 27"x36" Bed Area, 60 tons cap., M.D.

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400 tons CHAMBERSBURG Hydraulic Wheel Press, 14" Ram, 96" between Tie Bars, 12' to End Support. M.D.

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4"x12" LANDIS Hydraulic Plain Cylindrical Grinder, M.D., Late Type.

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15'x10'x36' BETTS double housing Planer, 4 swivel heads tendant control box table Motor Driven.

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DRILLS

1 spdl, 14" sw. #2 Avey, new 1945
1 spdl, 20" sw. #2LMS L.-G., 1945
1 spdl, 24" sw. #2MA6 Avey, new 1942
1 spdl, 30" sw. #4MS L-G. hydraulic
2 spdl, 24" sw. #3 Avey, AC MD.
3 spdl, 20" sw. #2LMS L-G. 1942
3 spdl, 24" sw. #3MS L-G. new 1943
3 spdl, 24" sw. #2MS Allen, 1942
4 spdl, 14" sw. #2LMS L-G. new 1942
4 spdl, 20" sw. #2LMS L-G. new 1944
6 spdl, 20" sw. #2LMS L-G. new 1942
6 spdl, 36" sw. #2LMS L-G. new 1943
#314-A Baker Univ H.D., 1942
16 spdl, Fox #K60H, #2 taper, 1944

BORING MACHINES

Pratt-Burt Vert. 20" sw. new 1941
42" Bullard VTL. side hd. 1942
#49 Heald Baromatic, new 1944

GRINDERS

3"x12" #5 B&S, Rap. Trav., 1942
4"x12" #4H Landis, 1942
6"x18" Norton Type C, new 1942
10"x18" Norton Type C, new 1943
10"x36" Norton Type C, new 1942
10"x48" Norton Type C, new 1943
10"x12" Hill-Clarke, AC Mot. Dr.
10"x36" Hill-Clarke, AC Mot. Dr.
10"-20"x36" Norton, angular wheel
14"x48" Landis Type C, new 1941
16"x12" Hill-Clarke, AC Mot. Dr.
16"-26"x12" Norton, AC MD, 1941
42"x12" Norton, extras, new 1942
18"x96" Hill-Clarke, AC Mot. Dr.
18"x120" Norton Plain Cyl.
20"x192" Norton, AC Mot. Dr.
24"x264" Norton, AC MD, Rebuilt
24"x72" Gap x 114" Norton Pl. Cyl.
14"x48" Landis Type C Univ. chuck
#371 Heald Sine-Matic, 1950
#5A Bryant Internal, new 1943
#16A-16 Bryant Internal, new 1943
#16-36 Bryant Internal, new 1941
#24-36 Bryant Internal, new 1941
#24-36 Bryant Internal, new 1941
#72A5 Heald Internal, new 1942
#72A5 Heald Bridge Type Int.
#214 Besly Double End Disc, 1940

LATHES

16ML-16"x36" LeBlond Auto.
#16ML-16 LeBlond, Semi-Auto. 36" sw
14"x36" Amer. Grd. Hd., MD
27"x84" Amer. Grd. Hd., MD
24"x42" Fay Auto, AC MD.
36"x120" Putnam Grd. Hd., MD
R14 Seneca Falls 16"x36", 1942
12"x24" or N.-H.-F. ser. 3300
#SW Clim Acme Univ. Turret
#4 Gisholt Univ. Tur., A. C. & B.F.
#3AL Gisholt, cross-slide Tur. 1941
#3H-16 Libby H.D. Tur. 1942
#4A W&S Turret, new 1944
#PU Pratermatic, tur. 32" sw. 1944
#8D Potter & Johnston, new 1941

MILLERS

54"x20"x16 Ingersoll Slab, 1934
54"x8' Ingersoll Openside, 1942
54" Ingersoll Vertical Rot.
#28-66 Cinn. 4 Spdl. Vert. 1942
#35-72 Cinn. Horiz. 1942
10"x60" P&W Mod. B Thread Mill
#CT L-B Thread Mill, new 1942
No. 2 Cinn. Univ. Hi-Power
#26 Van Norman, Rebuilt, 1941
#1-18 Van Norman Prod. 1942

PLANERS

36"x36"x12' Rockford Openside '42
60"x48"x27' American, 4 hds.
60"x48"x30' Hamilton, 4 heads

MISCELLANEOUS

#3L La Pointe 18T Horiz. Broach
6" Goss & DeLeeuw, 8 spdls. 1941
#306 Barnes Vert Hone, new 1943
15 Ton Hyd. American Press, 1946
#11RD 2 Hd. W&S Tapper, latest
#12HB G&E 12" cap. Gr. Hobber
#36BM G&E 3 Spdl. Bevel Gr.
#612-A Fellows Gr Shaper, 18" cap.
#6A Kaufman Pneu. Tapper, 1947
#HRS Barber-Colman Sharp Mach.
16 ga. 42" Economy Power Shear
6"x6" Peerless H.D. Hacksaw, 1943
15 T Toledo Overhead Crane, 39½'

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PRACTICALLY NEW DOUBLE CRANK PRESSES

Bliss No. 9-108W, cap. 400 tons, Bed 108"x80".
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All Machines have Air Clutch and some have Air Cushions and Motor Driven Ram Adjustment. Still set up in Plant

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- SBD 72-30 American Duplex Vertical Broach 30-ton 72" stroke. 1943
- 36" x 240" Centers Niles
- Timesaver Engine Lathe. New in 1941.

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ELECTRIC FURNACES TO 1850F
with Auto Temp Control. Sliding door, heavily insulated, substantial, accurate, dependable for machine shop, tool room, laboratory New
8"x12"x15" inside 4.5 K.W. $300.00
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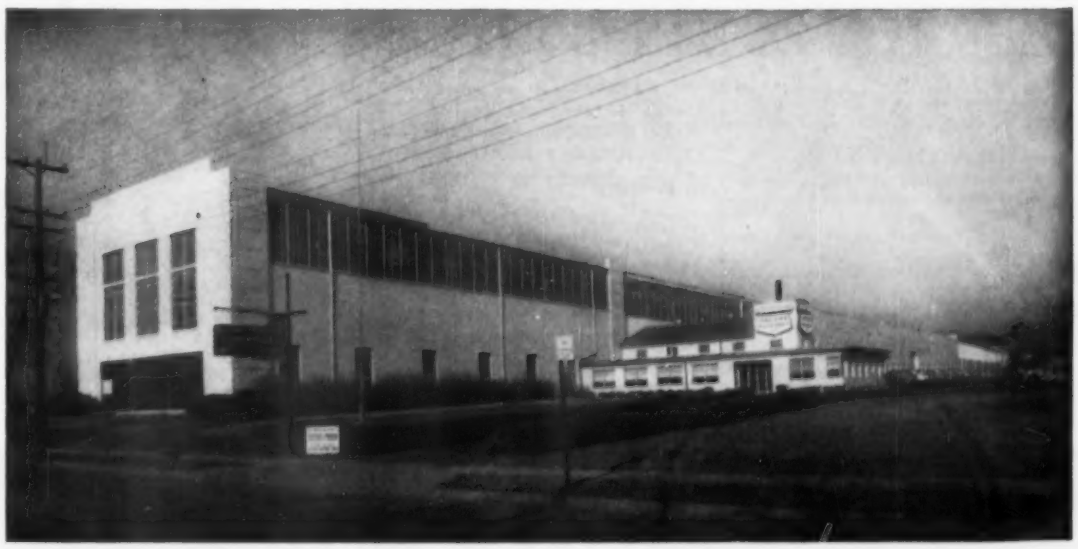

AUTOMATICS

¼" Cleveland Model A, m.d., 1943
Model 1½B-18 Cleveland, single spindle, m.d.
Model B—1-1/16" Cleveland, m.d.
4 spindle 1⅝" Cleveland Model M, m.d.
2" Cleveland Model A, single spindle, m.d.
4 spindle—2" Cleveland Model K, m.d.
2½" Cleveland, m.d., Model A
No. 8A Cleveland, m.d., 8" cap., latest
14" Fay Flanders Type, m.d.
No. 6C Potter & Johnston, m.d.
No. 5D Potter & Johnston, m.d.
No. 5 DELX Potter & Johnston, m.d., late
No. 6 DREL Potter & Johnston, m.d., late type

BOLT THREADERS

Victor Nut Facing Machine, m.d., cap. ⅜" to 2" nuts
1½" Landis 2 spindle, older type
1½" Landis Stay Bolt Threading Machine, Double Head, m.d.
No. 32G Oster Bolt & Pipe Threading Machine, m.d.

HORIZONTAL BORING MILLS

No. 25T Giddings & Lewis, m.d., late
No. 32 Lucas, m.d., 3¼" spindle
Barrett Double End, 2" and 5" spindle, m.d.
5½" bar Betts Floor Type, m.d.
5½" bar Niles-Bement-Pond, m.d.
10" bar Sellers Floor Type, m.d.
Floor Plates—all sizes

VERTICAL BORING MILLS

16" Bullard Mult-Au-Matic, m.d.
24" Bullard Spiral Drive, 1943
42" Bullard New Era, m.d.
42" King, direct m.d., thru gear box
42" King with side head and plain swivel head on rail, 1940
44" Putnam, m.d., p.r.t.
48" Niles-Bement-Pond Car Wheel Borer, m.d.
53" Niles Heavy Pattern, m.d., p.r.t.
62" King, m.d.
100" Niles Heavy, m.d., p.r.t.
102" Niles Wheel Turning Boring Mill
12' Niles, m.d., p.r.t.

BROACHING MACHINES

75 H.P. LaPointe Hydraulic Broach, m.d.
12x72" Thompson Automatic Flat Broach, m.d.
10 ton, 54" stroke LaPointe Single Ram Vertical Surface Broach, m.d., late
Type SD, 42-6 American Vertical Hy. Dup. Broach
Type SBD-48-15 American Vertical Dup. Ram Surface Hydr. Broach
No. 3 Oilgear Hydraulic Broach, type XA, 54" stroke, m.d.

RADIAL DRILLS

3'-10" col. American Triple Purpose, m.d. thru gear box
4'-13" col. American Triple Purpose, m.d. on arm
5'-14" col. Carlton, m.d.
6'-19" col. Foodick "Economax", m.d. on arm
7'-16" col. American Triple Purpose, m.d.
7'-17" col. American, Universal Table
8'-17" col. Drotes, gear box m.d.
Zeus Precision Universal Bench Type Radials, m.d., new
Baush Radial Drilling & Tapping Machine, m.d.

BALL BEARING DRILLS

No. 4 Foodick, 8 overhang, High Speed, m.d.
No. 15 Buffalo Floor Model, m.d.
No. 18 Canedy-Otto Bench Model, m.d.
No. ½, 1, & 2 Avey, belted m.d.
No. 1B Edlund, m.d., new
1 spindle No. 2MA6 Avey High Speed, m.d., 7½ overhang, 1943
2 spindle Allen, belted m.d., 8" overhang
No. 2LMS Leland-Gifford, single spindle, High Speed, m.d.
No. 2LMS Leland-Gifford, H.S. Hydraulic Feed, m.d.
2 spindle No. 2 Avey High Speed, belted m.d.
2 spindle No. 2B MA1 Avey Production Type, m.d.
2 spindle Avey, size No. 1, Type B, style VHP, m.d., 8" overhang
2 spindle No. 3MA6 Avey High Speed, m.d.
2 spindle No. 2 Leland & Gifford High Speed, 8" overhang, m.d.
3 spindle No. 2MA6 Avey High Speed, m.d.
3 spindle No. 2 Avey, High Speed, m.d.
3 spindle Leland & Gifford 2½LMS—High Speed, late, m.d.
3 spindle Leland & Gifford High Speed, Model 3MS, m.d.
4 spindle Leland & Gifford, m.d. on each spindle
4 spindle No. 4 Allen High Speed, m.d., 1943
6 spindle Leland & Gifford, m.d. on each spindle No. 2 taper
6 spindle No. 1 Avey High Speed, m.d.

HORIZONTAL DRILLS

3 way Natco Horizontal Drill, consisting of 3 E13 Hoeunits
No. ½B-50" Pratt & Whitney Gun Barrel Rifling Machine, m.d., latest
No. 18x74" Pratt & Whitney 2 spindle deep Hole Reaming Machine, m.d.
No. 1½x105" Pratt & Whitney 2 spindle Gun Barrel Rifling Machine, m.d.
No. 1 Pratt & Whitney 2 spindle Deep Hole Drill, belted m.d.
Model 410 W.F. & John Barnes, 2 spindle Hydraulic Deep Hole Drill, m.d.
Pratt & Whitney Deep Hole Drill Sharpener, m.d.
Natco Horizontal Drill, holestool model, m.d., 1942

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THE EASTERN MACHINERY COMPANY
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CABLE ADDRESS
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BUT YOU CAN BUY IT FOR LESS THAN HALF OF REPLACEMENT PRICE! AND GET IT NOW!

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4' Arm 13" Column Western heavy duty radial drill, new 1952.

28"x20' bed Lodge & Shipley lathe, 10 HP Turner drive.

No. 8 Buffalo Bar & Billet shear.

No. 2 Cincinnati tool & cutter grinder, new 1941.

30" No. 18 Blanchard rotary surface grinder, serial 3285, new 1941.

Model 34-36 Cincinnati duplex mill, serial 3B33D14-4.

No. 74 Heald hydraulic plain internal grinder, w/cross-sliding H.S., new 1941

No. 72A5 Heald hydraulic plain internal grinder w/extended bridge, new 1943.

No. 1-H-18 Kearney & Trecker simplex mill, late

2000 Ton No. 6 National Maxipress, all steel frame.

7" No. 76H Baird Chucker, new 1943.

Pratt & Whitney Kellering Machines (7)

No. 20-60 Oilgear dual ram surface broach, 1940.

24" No. 314 Baker Brother H. D. Drill.

16 Spdl No. D20H Natco multiple drill, 1943.

36" No. 36H Gould & Eberhardt gear hobber.

No. 2 Cincinnati filmatic bearing centerless grinder.

4" x 12" No. 4H Landis plain hyd. cylindrical grinder, 1943.

13" x 60" Hanchett vert. spdl. surface grinder, late.

6" x 18' Norton horiz. spdl. surface grinder.

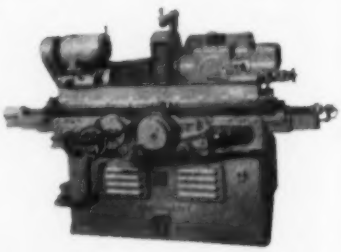
24" x 8' Bed LeBlond H. D. Engine lathe.

126" x 96 ft. cc. Niles Bement Pond engine lathe.

15" x 30" Lipe Carbo-Matic production lathe, 1942.

36" Rockford hydraulic openside shaper-planer.

36" Rockford hydraulic vertical slotter, new 1944.



(1) 6"x30" Cincinnati type EA Filmatic bearing plain cylindrical grinder with hydraulic quick infeed. Serial No. SPICIL98, new in 1942. Completely rebuilt and guaranteed.

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Ingersoll 42"x42"x14' adj. rail planer type MILLING MACHINE.

K & T 5-H Plain MILLING MACHINE.

Pratt & Whitney M-30 single spdle. Vertical Profile MILLING MACHINE.

Cinn. 0/8 vert., 0/8 plain, 0/8 r & f 1-12 PRODUCTION MILLERS.

J & L #8-B TURRET LATHE rapid trav. to cross slide, chucker.

W & S #4 TURRET LATHE.

Gisholt 1L, 2½" TURRET LATHE.

Sundstrand #8 PRODUCTION LATHE.

Giddings & Lewis #25RT HORIZ. BORING MILL 2½".

Defiance 4" BORING MILL table type.

Heald 47-A BOREMATIC hyd. cross table.

Moore #1 Precision JIG BORER.

Norton 16"/26"x72" hyd. semi-auto. CYLINDRICAL GRINDER.

Landis 4-H CYLINDRICAL GRINDER.

Thompson 12"x16"x60" hyd. SURFACE GRINDER.

Fellows 12" GEAR SHAVER, spur & helical gears.

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Thomas Street Worcester, Mass.

FOR SALE

#4A W&S UNIV. TURRET LATHES, new '53 & '38; 1-saddle type power traverse; used very little $9,500 and up.

5¾" CLEVELAND AUTOMATIC, Model A, new '43, fully equipped.

36" x 6 cc LODGE & SHIPLEY GEARED HEAD LATHE, hevi duty, ser. 23756 quick change, face plate, steady rest, excellent $3,975.

TOLEDO DBLE. ACTION PRESS, Model 169¼-5, 780 tons capacity.

LOCOMOTIVES & CRANES, 25-35-45-50 tons, Diesel electric.

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EDison 4-9471-2

60" x ¾" ROLLER LEVELER

McKay Universal 2-Hi; New 1942; seven 60" x 10" Rolls; ¾" mild steel capacity; 75 H.P. AC motor drive; EXCELLENT CONDITION.

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Serving the World's Largest Manufacturers

#45—8" Giddings & Lewis Horizontal Table Type Boring Mill Serial #18151

42" Bullard Vertical Serial #19788

(2) 13" Peerless Power Hack Saws

#72A5 Heald Sizematic Internal Grinder Serial #12276

30" x 10' Hanchett Plano Surface Grinder. Excellent.

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NEW - USED REBUILT MACHINERY

HAZARD BROWNELL MACHINE TOOLS INC.

350 WATERMAN STREET PROVIDENCE 6, R. I. DEXTER 1-8880

FOR SALE AUTOMATIC SCREW MACHINE

1—No. 8 A Cleveland 8" Model A single spindle, Serial 38122-3; 42, with 4-speed motor. Full range gears complete with feed shell pads 4" to 7". First class operating condition. Call—

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Philadelphia—MAyfair 4-6600

or write

FS-1606, AMERICAN MACHINIST

330 W. 42 St., New York 36, N. Y.

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LANDIS Type CH Grinder, Hyd. 14"x36"—1950.

WARNER SWASEY Model 2A, serial #979,000, complete.

Model A CLEVELAND 2-1/2"—1946.

WARNER SWASEY 3A. Timken—1935.

42" BULLARD, serial #11,500.

LEES BRADNER Thread Miller, 12x36—1947.

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BARNES model H-3; 3" cap., 24" swing, #5 M.T. Hydram; late type
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LELAND & GIFFORD #1LMS 2 spindle; H.S.; M.D.; late type
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BRYANT No. 16-C-16 Internal; hydr. late
BRYANT No. 16-CP-16 Internal; late type
BRYANT No. 16-36 Internal; hydraulic gap bed; late type
BRYANT model 24-L-26; latest type
BRYANT model 112Y Hydr. Feed Grinder; late type
CHURCHILL No. 3 Internal; 8" stroke
HEALD No. 72A3 Plain Internal; late
HEALD No. 72A5 "Gagematic" Internal
HEALD No. 75 Centerless; motor drive
HEALD No. 81 pl. chuck type; late type
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BLANCHARD No. 11 Surface Grinder; late type
BROWN & SHARPE #2; motor drive; late
HEALD #22 Rotary; 12" chuck; M.D.
HEALD No. 25A Rotary; 30" chuck; late
HEALD No. 291 Rotary Surface Grinder; 12" chuck, latest type
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CONOMATIC 4⅝", 4-spindle; late type
GREENLEE 1⅝" 6-spindle; late type
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LeBLOND 16"x36" centers Auto.; Timken
LeBLOND Model 7ACL Crankshaft; 9"x30"
LeBLOND 20"x48" centers, H.D. Timken; late
LeBLOND 25"x54" Mfg.; latest
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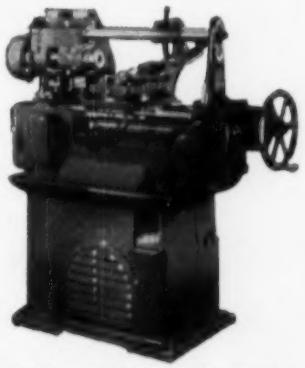

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LODGE & SHIPLEY 24"x54"; Timken
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LoSWING 4"x84" centers, late type
LoSWING 8"x108" centers, late type
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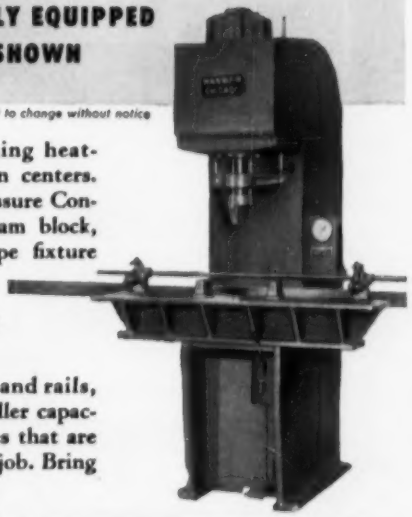

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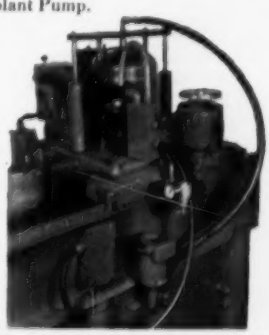

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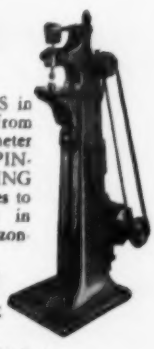

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WATCH always for the jobs you *can't* do—well. Specialized equipment and specialized knowledge outside may be worth the extra cost in reduced scrap and headaches. Sometimes the price may be less too—and it costs nothing to get an estimate.

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Handle your small part precision JIG BORING on the LINLEY JIG BORER

Why tie up your big, costly jig borers on small work when you can get maximum utility at less cost per hour on a machine exactly fitted to your work. Put your small work on the LINLEY where it belongs and reserve your large machines for large work, *where large work belongs*. You'll save money this way.

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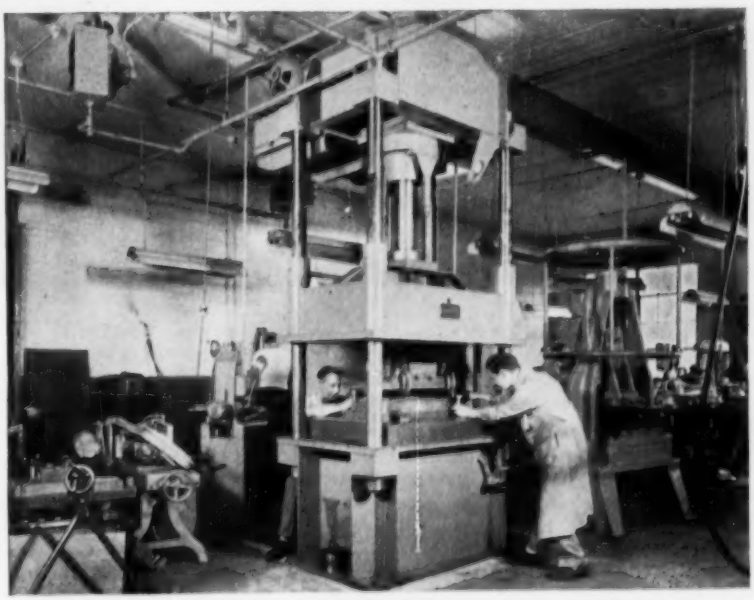

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As in most such shops, his only means of trying out dies was a hand power screw press which sometimes needed six or seven men to get the needed pressure.

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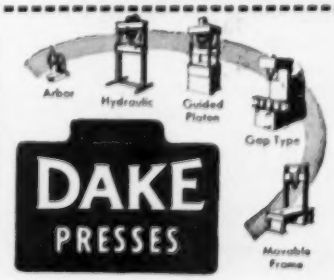

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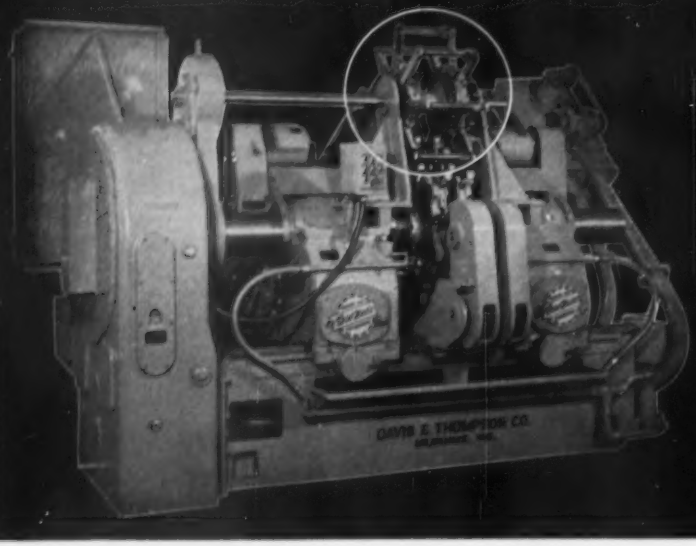

This continuous type milling and centering machine has been furnished with an automatic unloader (indicated by circle) which transfers finished parts onto a conveyor or discharge chute. Milling and centering of both ends is done simultaneously and in continuous production.

Basically, this is a standard ROTO-MATIC machine tooled-up to handle special production requirements. Rough and finish milling and centering spindles in both heads have micrometer endwise adjustment. Heads are adjustable on the ways. With equalizing jaws in fixtures plus chain clamping, machine is fully automatic.

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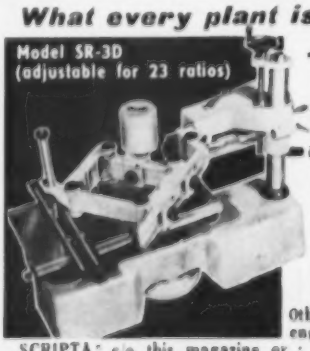

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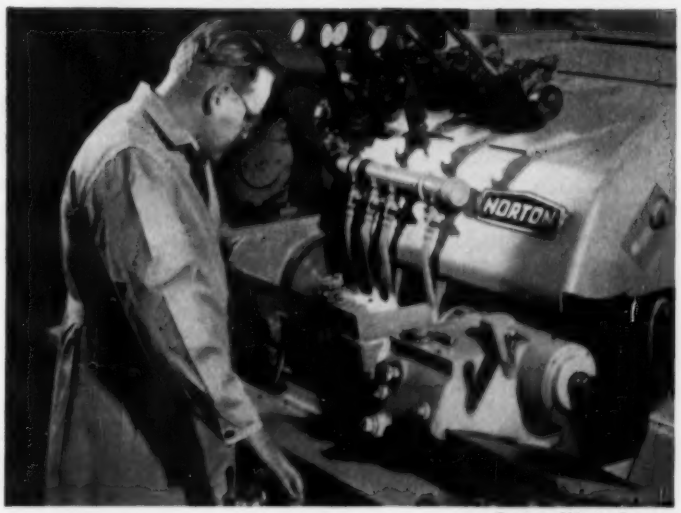
PRESTO!

an "Open Wheel" with "1500"



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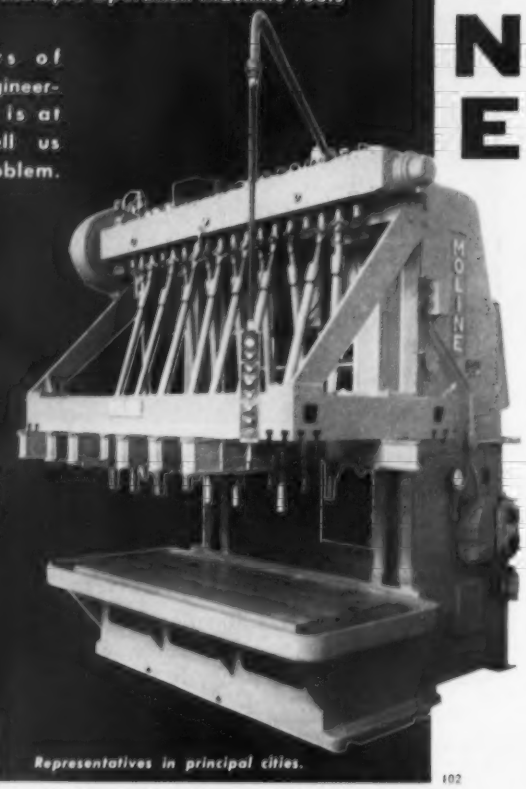

HU68 drilling machine with fourteen spindles adjustable in a 72 inch by 24 inch drilling area. Other sizes available.

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SHELDON Precision LATHES

for the size Lathes

You Need Most

Sheldon lathes are built in the sizes you need most, for toolroom and production jobs. They are available with swings of 10", 11" and 13"... in varying bed lengths with 18" to 48" center distances . . . and . . . in your choice of pedestal, cabinet or bench mountings.

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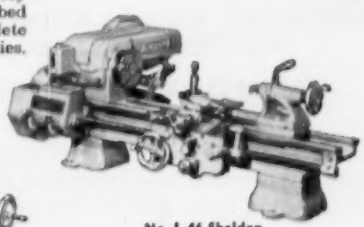
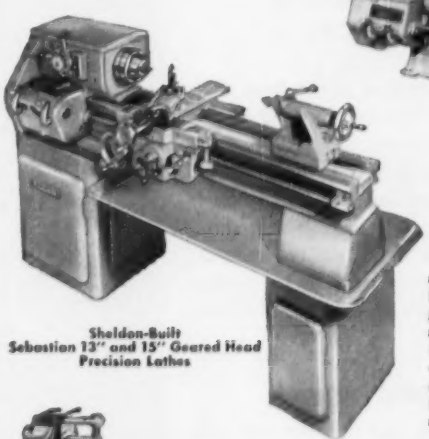


No. L-46 Sheldon 10" Precision Lathe



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SHELDON 12" Shaper

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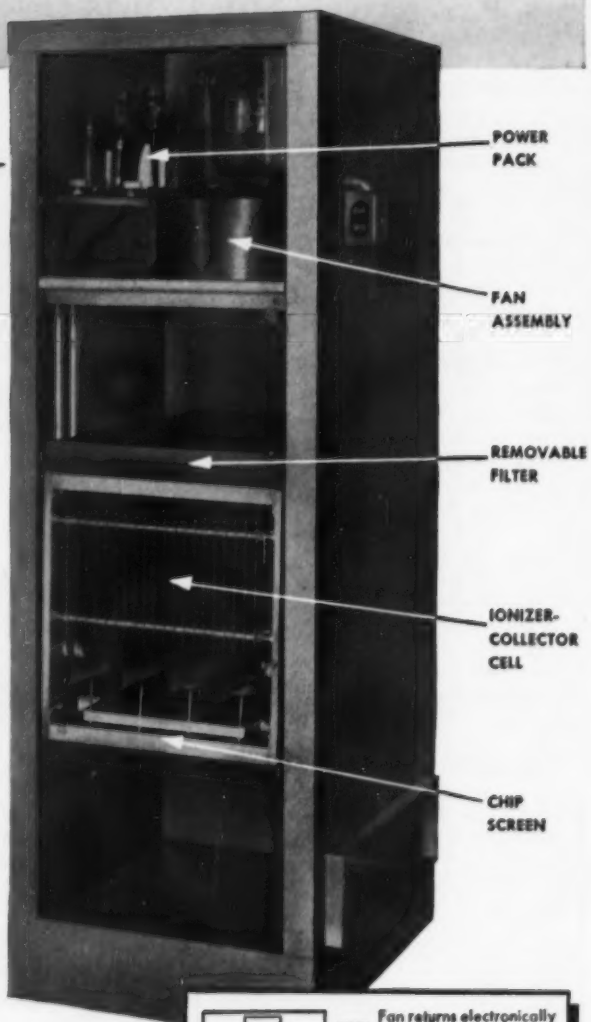

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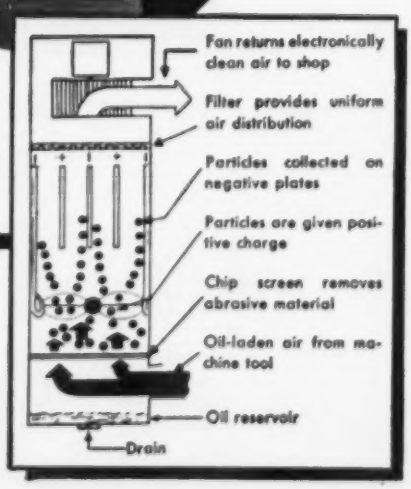
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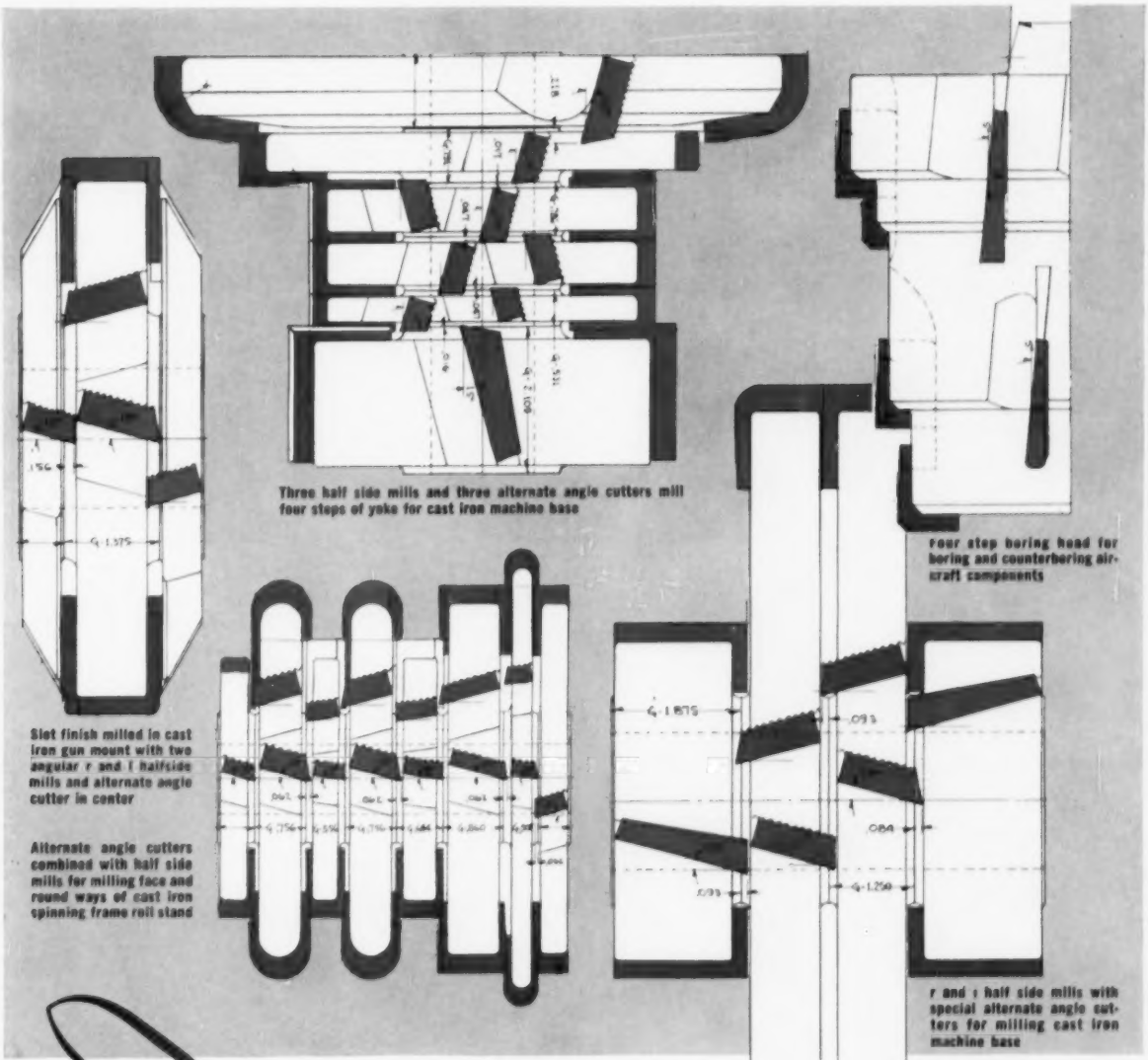

Three half side mills and three alternate angle cutters mill four steps of yoke for cast iron machine base

Four step boring head for boring and counterboring aircraft components

Slot finish milled in cast iron gun mount with two angular r and 1 halfside mills and alternate angle cutter in center

Alternate angle cutters combined with half side mills for milling face and round ways of cast iron spinning frame roll stand

r and 1 half side mills with special alternate angle cutters for milling cast iron machine base

Free - 50p Book

engineering data
tooling specifications
and helpful information

This book of fifty O K Tool prints shows how leading manufacturers in aircraft, automotive, electrical and machinery industries meet rising production costs with *new multidiam boring heads* and *milling cutters* — new tools that do up to eight and ten metal-removing operations with a single stroke of the machine or one pass of the tool.

Special heads bore and face at four levels, chamfer some holes, all in a few minutes. Savings in man hours and machine time can be reduced to one-sixth of the previous cost.

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OK **modern milling cutters for modern milling machines**

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name _____

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products manufactured _____

_____

employees _____

Equipment: how many boring mills _____

milling machines _____ lathes _____

planers _____ shapers _____

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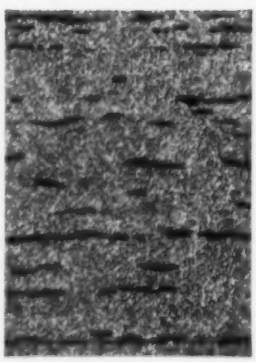
CHANCES are you can make your gages or dies last three times longer by making them from Graph-Mo® tool steel. Users report that Graph-Mo tool steel outwears other tool steels on an average of 3 to 1. A combination of free graphite and diamond-hard carbides in its structure makes this possible.



100 times magnification of Graph-Mo showing free-graphite and diamond-hard carbides.

And you can make gages and dies *faster*, too, with Graph-Mo. Constant Pressure Machinability tests show that Graph-Mo steel machines 30% faster than other tool steels.

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Because Graph-Mo steel has a minimum tendency to pick up, scuff or gall, it makes for a much better surface on your dies and gages. Graphite particles in Graph-Mo steel act as a "built-in" lubricant. Tests on the Amsler Wear Machine show Graph-Mo steel has twice the resistance to galling compared with ordinary tool steels.

So to get the most wearable, machinable and stable tool steel there is, get Graph-Mo. You can readily tell it by its "graphitic look"—the tiny, scattered parallel marks just barely visible on a piece of polished Graph-Mo. Insist on this "trade-mark" that's part of the steel

Graph-Mo steel plug gage tested for 12 years to prove stability.

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